BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

I, Robert E. Dick, declare as follows:

1. I am of sufficient age and am competent to testify in this proceeding. I make this declaration based upon personal knowledge and am competent to testify to the facts set forth herein.

2. This supplemental declaration is made for the January 16, 2024 status and modification hearing on the Stipulated Order for Abatement ("Stipulated Order") adopted on September 6, 2023. This declaration supplements the declaration submitted to the South Coast AQMD Hearing Board (the "Hearing Board") on December 1, 2023. The initial declaration contains my background and credentials, and my experience working with the Chiquita Canyon Landfill ("Landfill"). That declaration also includes a description of the leachate issues experienced by the Landfill, including discharges of pressurized leachate. To the best of my knowledge at this time, everything stated in my December 1 declaration remains true and is applicable for this January 16, 2024 status and modification hearing.

3. This supplemental declaration presents an overview of what we have learned about the Elevated Temperature Landfill ("ETLF") event (also referred to as a landfill reaction) occurring at the Landfill and the actions taken by Chiquita Canyon, LLC ("Chiquita) to mitigate the ETLF event. It also describes work that I have accomplished on behalf of Chiquita and other actions that Chiquita has taken to comply with the Stipulated Order, and explains some of the proposed modifications and additions to the Stipulated Order that the parties are asking the Hearing Board to approve at the January 16, 2024 hearing.

No Evidence that the Reaction Is Expanding

4. The Landfill is experiencing the typical symptoms of an ETLF event, including elevated temperatures, increased production of landfill gas and liquids, changes in landfill gas and liquids/leachate composition, distinct odors, accelerated settlement, and significant subsurface pressures.

5. On September 6, 2023, the Hearing Board adopted the Stipulated Order to address the ETLF event at the Landfill.

Assessment and Evaluation of the ETLF Event

6. Since September 6, 2023, Chiquita has undertaken numerous actions to assess, evaluate, measure, and investigate the ETLF event and its potential causes. These actions include conducting an investigation and preparing an expert report on the potential causes of the ETLF event, measuring and tracking landfill gas wellhead temperatures, measuring and tracking the concentrations of sulfur compounds, methane, and hydrogen (among other constituents) in the landfill gas, measuring and tracking settlement of the landfill surface, conducting odor surveillance in the neighboring communities, enhancing its community air monitoring program, initiating the planning for an in-situ waste temperature monitoring system, and much more. Each of these actions have provided Chiquita with more information on the status of the ETLF event, but it is still premature to proclaim a definitive conclusion about the extent that the ETLF event is progressing and potentially propagating or contracting.

7. The number and position of landfill gas wellheads that have consistently recorded temperatures greater than 160 degrees Fahrenheit for the past four months (September through

December 2023) is relatively constant, which suggests that the location and intensity of the ETLF event is relatively unchanged during this period.

8. Chiquita maintains records of the quantity of leachate collected at the Landfill and evaluates the weekly leachate quantity totals to assess whether the rate of leachate production is increasing or decreasing and whether such changes are attributed to the landfill reaction or attributed to other circumstances (precipitation events, mitigation efforts, etc.).

9. The overall size of the area of the Landfill affected by the reaction has remained fairly constant, and the ETLF event has remained confined to the northwestern portion of the Landfill. The boundaries of the Reaction Area as defined in the Stipulated Order have remained unchanged. While there may have been some short-term fluctuations in the specific wells experiencing increased temperatures on the boundaries of the area of the Landfill affected by the reaction, those short-term fluctuations do not mean that the overall ETLF event is expanding or contracting. In fact, in the most recent Reaction Area review report submitted on January 5, 2024, the DMS Committee noted that data from the previous month showed that there were some areas within the previously delineated area of the landfill affected by the reaction that did not exhibit any of the ETLF criteria conditions used in the monthly boundary assessment exercise during December 2023. Nevertheless, the DMS Committee felt that it was prudent to maintain the current boundaries of the area of the landfill affected by the reaction for the monthly boundary assessment exercise to enable evaluation as to whether this constituted a trend of contraction of ETLF conditions, which will be evaluated over the next several months.

10. The measurements that have informed the monthly boundary assessment exercise, which have resulted in consistency of the delineated area being affected by the reaction for the period of September through December 2023, are good indications that the ETLF event is being contained and managed, and not propagating or continuing to expand, but Chiquita's assessment and evaluations are ongoing. Further efforts to address the ETLF event are anticipated to remove heat, which is expected to eventually diminish these ETLF conditions.

Actions Taken to Mitigate the ETLF Event

11. Chiquita has taken numerous actions to slow and stop the ETLF event, both under the Stipulated Order, and in coordination with Chiquita's other regulators. Central to slowing and stopping the ETLF event is preventing the accumulation of heat by aggressive removal of hot fluids (gas and leachate), and preventing the conditions that enable the ETLF event to occur, including elevated temperatures and pressure.

12. To summarize, since September 6, 2023, Chiquita's actions to slow and stop the ETLF event include:

a. Installing and beginning to operate a new permanent flare (Flare 3) and one additional portable thermal oxidizer;

b. Installing 44 new or replacement vertical landfill gas wells;

c. Installing a temporary cover (scrim-reinforced geomembrane ("scrim")) over a portion of the western slope of the Reaction Area until the geosynthetic cover can be installed to reduce odors and prevent rainwater infiltration;

d. Beginning the preparatory work required to install the geosynthetic cover over portions of the Reaction Area; and

e. Beginning to install well boots seals on all wells in the Reaction Area.

13. Chiquita has also taken many actions to alleviate the potential impacts of the ETLF event, both under the Stipulated Order and in coordination with Chiquita's Local Enforcement Agency. Since September 6, 2023, Chiquita's actions to address the impacts of the ETLF event include:

a. Installing the scrim over the lower portion of the western sloped area of the Reaction Area;

b. Beginning the preparatory work to install the geosynthetic cap over portions of the western and northern slopes and the top deck of the Reaction Area;

c. Making significant repairs to the western sloped area of the Reaction Area;

d. Collecting and containing pooling or ponding liquids/leachate;

e. Installing and maintaining a semi-permanent vapor odor control system and a landfill perimeter odor control misting system;

f. Providing California Air Resources Board certified air filtration devices as well as replacement air filters to residents in the communities surrounding the Landfill;

g. Maintaining proper landfill cover; and

h. Maintaining the fresh trash odor mitigation best management practices from the prior Stipulated Order.

Compliance with the Stipulated Order

14. As required by **Condition 12** of the Stipulated Order**,** Chiquita selected and contracted with six individual consultants to form the DMS Committee. I am one of the members of the DMS Committee. On behalf of the DMS Committee, I notified the South Coast AQMD of the formation of the committee and the committee members on October 6, 2023. In my notification, I provided the names and curriculum vitae and/or resumes of each DMS Committee member. Correct and true copies of these curriculum vitae and/or resumes are attached to this declaration as **Exhibit A**.

15. One of the roles of the DMS Committee is to evaluate the size of the Reaction Area on a monthly basis (see **Condition 9(a), (b)**). Each month following the issuance of the Stipulated Order, the DMS Committee, led by myself, reviewed data compiled from the past month, including landfill gas wellhead temperatures, landfill gas composition, landfill surface settlement, cracks in the landfill cover, the presence and quantity of liquids, and the presence of hydrogen in the landfill gas. Based on this data, we determined the boundaries of the area of the landfill affected by the landfill reaction, an area we refer to as the "data-driven reaction area." We then compared the boundaries of the data-driven reaction area to the boundaries of the Reaction Area, a larger, more protective area initially defined in Condition 9, and made a determination as to whether the boundaries of the Reaction Area needed to change. For example, if the boundaries of the data-driven reaction area were to extend beyond the boundaries of the Reaction Area, then our determination would likely be that the boundaries of the Reaction Area needed to expand to

encompass the data-driven reaction area. This particular scenario has not occurred during the initial four monthly boundary assessment exercises accomplished to-date.

16. Each month, I submitted reports to the South Coast AQMD on behalf of the DMS Committee presenting our determination. These reports included a narrative summary of our review and determination, and a revised map of the data-driven reaction area, outlined in magenta dashed lines, and the Reaction Area, outlined in solid black lines. I submitted these reports to South Coast AQMD on October 6, November 6, and December 6, 2023 and January 5, 2024. Correct and true copies of these reports are attached to this declaration as **Exhibits B through E**.

17. As noted above, the size of the Reaction Area as defined in Condition 9 of the Stipulated Order has not changed. Based on the DMS Committee's review of the data, the ETLF event has not expanded to a new landfill cell or module. The December 6, 2023 Reaction Area review report notes that one additional well meets the criteria considered by the DMS Committee when determining the extent of the area affected by the ETLF event (see Exhibit D). Thus, the DMS Committee slightly modified the data-driven reaction area (i.e., the dashed magenta line) to incorporate that one additional landfill gas well, but this modification did not necessitate a modification to the boundary of the Reaction Area (i.e., the solid black line). The data-driven reaction area remained within the boundary of the Reaction Area.

18. It is important to note that short-term variations, fluctuations, and changes to the operational parameters (pressure, temperature, gas composition) measured at individual wells in and around the area of a landfill experiencing an ETLF event are not uncommon. There are times when a well may experience a relative increase in temperatures for a month or two, but that is not necessarily indicative of the expansion of the ETLF event. At the same time, wells that exhibit a relative decrease in temperatures for a month or two, such that they do not satisfy the criteria thresholds being applied and could have been removed from the data-driven reaction area, are not necessarily indicative of a contraction of the ETLF event. In short, the addition (or elimination) of a small number of individual wells from the data-driven reaction area over a short-term period (only a few months) is not evidence that the ETLF event is either expanding or contracting; it is not until changed conditions are persistent and pervasive that we typically make a determination regarding

the evolution and life-cycle of the landfill reaction. For the purposes of the Reaction Area review of the November 2023 data, the DMS Committee felt it prudent to be conservative and included the one additional well that was exhibiting the characteristics of an ETLF event.

19. The DMS Committee again felt it prudent to be conservative in the January 5, 2024 Reaction Area review report (see Exhibit E). That report notes that data from the previous month shows that there are some areas within the data-driven reaction area (i.e., the dashed magenta line) that did not exhibit any of the ETLF criteria conditions for inclusion in that area based on the December 2023 data. Nevertheless, the DMS Committee maintained the current boundaries of the data-driven reaction area for the month to enable evaluation as to whether this constituted a trend of contraction of ETLF conditions, which will be evaluated over the next several months.

20. The DMS Committee is also charged with investigating the reaction and preparing a number of expert reports. The DMS Committee divided up primary responsibility for these reports based on each committee members' area of expertise. I prepared the *Elevated Temperature Landfill Causation Investigation Report* and submitted it to South Coast AQMD on December 8, 2023 in accordance with **Condition 12(b)(ii)**. A correct and true copy of the *Elevated Temperature Landfill Causation Investigation Report* is attached to this declaration as **Exhibit F**.

21. For the purposes of the *Elevated Temperature Landfill Causation Investigation Report*, I conducted an investigation and study into the potential causes of the ETLF conditions, as well as corrective measures to contain and manage the ETLF conditions. At the Chiquita Canyon Landfill, a discrete portion of the waste mass is experiencing ETLF conditions, as opposed to a traditional subsurface oxidation event or subsurface landfill fire.

22. My investigation found that the causes of the ETLF conditions at the Landfill cannot be definitively identified. There are five categories of landfills that have experienced ETLF conditions: (1) landfills that have accepted significant quantities of aluminum dross or other types of secondary metals waste; (2) landfills that have accepted significant quantities of waste-to-energy incinerator ash, coal combustion residuals, or other industrial ash waste materials; (3) landfills that have accepted significant quantities of sludge or biosolids; (4) landfills that have experienced a slope failure or other large-scale waste relocation; and (5) landfills that have none of the four

preceding attributes. The Chiquita Canyon Landfill fits into this fifth category. It has not accepted significant quantities of industrial wastes containing metals or ash, biosolids, or other special wastes. There is no evidence that the Landfill has experienced a slope failure or substantial waste relocation endeavors that may have contributed to the large-scale heating event at the Landfill. It is likely that the heat generated within the waste mass from typical anaerobic digestion processes accumulated to a point, inhibiting normal waste degradation processes, and were replaced by abiotic (non-biological) chemical reactions affiliated with ETLFs that become self-sustaining.

23. As stated in my report, there is no known method to quickly stop ETLF conditions. Best management practices, including increased gas extraction and liquid removal and improved cover integrity, are aimed at helping to slow the ETLF conditions and mitigate impacts.

24. Chiquita has been posting all DMS Committee expert reports on its Odor Mitigation webpage by including a brief narrative description of the report and hyperlinking the report, as required by **Condition 12(c)**. I understand that this webpage is updated on a weekly basis. Chiquita is also translating the information on the Odor Mitigation webpage into Spanish as required by **Condition 28**.

25. The DMS Committee is also responsible for evaluating and determining the wells with the worst liquid impaction issues. Pursuant to **Condition 17**, we determined the 20% of the landfill gas collection wells with the worst liquid impaction issues in the Reaction Area by reviewing landfill gas wellfield liquid level measurements and dewatering pump data recorded on November 1, 2023 at the Landfill and considering three criteria: 1) Lowest "Depth-to-Liquid" Distance; 2) Greatest "Liquid Column Depth" Measurement; and 3) Lowest Length of "Open Perforated Pipe Available". Utilizing these criteria, the DMS Committee identified 25 wells within the Reaction Area boundary as the wells with the worst liquid impaction issues. As of November 1, 2023, pumps were installed in 22 of the wells determined to have the worst liquid impaction issues in the Reaction Area. On behalf of the DMS Committee, I submitted this determination to South Coast AQMD on November 3, 2023. A correct and true copy of this determination is attached to this declaration as **Exhibit G**.

Proposed Modifications and Additions to the Stipulated Order

26. I understand that in advance of the January 16, 2024 hearing the parties have discussed proposed modifications to the Stipulated Order. I have reviewed the version of the proposed conditions that is current as of the date of this declaration. I believe that the modifications and new conditions described below are reasonable modifications or additions to the Stipulated Order.

27. The parties propose modifying the name of the DMS Committee to the "Reaction Committee" to better encompass the full scope of the issues that the committee addresses.

28. The parties propose modifying the text of **Condition 9(b)** to clarify that the Reaction Committee should submit a Reaction Area boundary determination each month, no later than seven days following the end of the month, regardless of whether the size of the Reaction Area had changed. This modification would not alter the Reaction Committee's current practice, but simply memorializes in the Stipulated Order what the Reaction Committee is already doing.

29. The parties propose adding a new condition (currently **Condition 49**) to require Chiquita to provide South Coast AQMD with a workplan listing all actions Chiquita plans to take to address the ETLF event. Under this proposed condition, Chiquita would also provide quarterly updates to this workplan. This proposed condition would aggregate the existing plans that pertain to how Chiquita intends to address the ETLF conditions into a single document, making it easier for South Coast AQMD and the public to identify, understand, and track all the steps Chiquita is taking to address these issues.

30. The parties propose adding a new condition (currently **Condition 51**) to require Chiquita to hold 30-minute biweekly virtual meetings between technical staff at South Coast AQMD and technical staff at Chiquita. These meetings would improve coordination between the two teams of technical staff, allowing South Coast AQMD to be updated on a consistent and frequent basis as to Chiquita's progress regarding implementation of the Stipulated Order and other mitigation measures implemented at the Landfill.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct to my personal knowledge.

Executed on this 9th day of January, 2024, in Powhatan, Virginia.

Robert E. Dick
Senior Vice President
SCS Engineers

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT A TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

ROBERT E. DICK, PE, BCEE

Education

B.S. – Civil Engineering, Virginia Polytechnic Institute and State University, 1989

Professional Licenses

- Professional Engineer – Virginia and North Carolina

Specialty Certifications

- American Academy of Environmental Engineers and Scientists (AAEES) - Board Certified Environmental Engineer (BCEE), Solid Waste Management Specialty

Professional Affiliations

- American Society of Civil Engineers (Member since 1989)
- Capital Region Workforce Development Board (Member since 2015)
- Environmental & Water Resources Institute
- International Solid Waste Association – Working Group on Landfills (Member since 2013)
- National Society of Professional Engineers
- National Waste & Recycling Association – Education Committee (Member since 2016)
- National Waste & Recycling Association – Services Board of Governors (Member since 2019)
- Solid Waste Association of North America – Landfill Gas Management Division
- Solid Waste Association of North America – Landfill Management Division
- Southwest Virginia Solid Waste Management Association
- Virginia Waste Industries Association – Past Chapter Chairman
- Virginia Waste Industries Association – Environmental Stewardship Committee Chair

Professional Experience

Mr. Dick joined SCS in 1990 and works on civil and environmental engineering projects related to solid waste management. He is a Senior Vice President, and serves as the Solid Waste Division Leader and Business Unit Director responsible for leading SCS' Engineering Practice in the USA mid-Atlantic region. He has performed landfill and landfill gas engineering projects (design, permitting, and construction) in more than 20 states and several foreign countries. He has worked on over 30 major landfill multi-task assignments involving new landfill cells, vertical and lateral expansion, closure, leachate management and treatment, post-closure care, groundwater monitoring, phasing operations, remediation, and financial assurance. He has performed over 200 landfill gas projects involving landfill gas migration control, odor control, fugitive emissions control and Clean Air Act compliance, energy recovery/utilization, and carbon credit monetization. His solid waste planning and facility projects have involved residential and commercial collection and recycling programs and material recovery facility design, permitting, construction, and operations consulting. His training course instructor assignments include courses for Virginia Department of Environmental Quality (VDEQ) personnel as well as the Virginia DPOR Waste Management Facility Operator's Training Course for Class I Basic and Class II Landfill/Composting courses.

Elevated Temperature Landfill Experience

Mr. Dick's credentials in the field of elevated temperature landfills (ETLF) related to the assessment, monitoring, management, and mitigation of abiotic landfill reactions at ETLFs are illustrated by the following projects:

Atlantic Waste Disposal Landfill, Waverly, Virginia, Waste Management, Inc. Project Director responsible for multi-task assignments at Elevated Temperature Landfill (ETLF) involving the following: planning summit for ETLF landfill reaction characterization and remedial strategies; field sampling and lab analysis of gas and leachate within landfill reaction area; engineering design of landfill gas collection system and liquids management system (both within and outside of landfill reaction area); engineering design of segregated landfill gas control system; landfill gas wellfield operations support; consulting on interim exposed geomembrane cap; odor monitoring, mitigation, and abatement.

Shoosmith Sanitary Landfill, Chester, Virginia, Shoosmith Brothers, Inc. Project Director responsible for multi-task assignments related to Elevated Temperature Landfill (ETLF) conditions in discrete portion of several cells with heat accumulation involving the following: planning and consulting for ETLF landfill reaction characterization and remedial strategies; field sampling and lab analysis of gas and leachate within landfill reaction area; engineering design and construction quality assurance (CQA) of landfill gas collection system and liquids management system; consulting on leachate pre-treatment unit processes; landfill gas system operations support; data analysis and temperature HOV reporting; air quality and solid waste permitting and regulatory compliance reporting/recordkeeping; ambient air dispersion modeling; odor monitoring, mitigation, abatement, and control plan; community engagement, public communications, and outreach.

Bristol Integrated Solid Waste Management Facility, Bristol, Virginia, City of Bristol Virginia Department of Public Works. Project Director responsible for multi-task assignments at Elevated Temperature Landfill (ETLF) involving the following: planning summit for ETLF landfill reaction characterization and remedial strategies; development of ETLF mitigation plan; field sampling and lab analysis of gas and leachate within landfill reaction area; engineering design and construction quality assurance (CQA) of in-situ temperature probes; design of automated wellhead temperature sensors with remote monitoring & control (RMC) telemetry network; engineering design and CQA of landfill gas collection system and liquids management system and unique sidewall fugitive emissions control system; permitting and design and CQA for leachate pre-treatment unit processes; permitting and engineering design of segregated landfill gas blower/flare control system; landfill gas system operations & maintenance support; permitting and design and CQA for an interim exposed geomembrane cap; data analysis and temperature HOV reporting; air quality and solid waste permitting and regulatory compliance reporting/recordkeeping; odor monitoring, mitigation, abatement, and control plan; community engagement, public communications, and outreach.

Confidential Sanitary Landfill, Virginia. Project Director responsible for multi-task assignments related to Elevated Temperature Landfill (ETLF) conditions in discrete portion of several cells with heat accumulation involving the following: planning and consulting for ETLF and landfill reaction characterization and remedial strategies; field sampling and lab analysis of gas and leachate within landfill reaction area; engineering design and CQA of landfill gas collection system and liquids management system (both within and outside of landfill reaction area); data analysis and temperature HOV reporting; air quality permitting and regulatory compliance reporting/ recordkeeping.

Confidential Sanitary Landfill, North Carolina. Project Director responsible for multi-task assignments related to Elevated Temperature Landfill (ETLF) conditions in discrete portion of several

cells with heat accumulation involving the following: planning and consulting for ETLF and landfill reaction characterization and remedial strategies; data analysis and temperature HOV reporting; air quality permitting and regulatory compliance reporting/ recordkeeping.

Chiquita Canyon Landfill, Castaic, California, Waste Connections, Inc. Principal Expert responsible for advising on multi-task assignments related to Elevated Temperature Landfill (ETLF) conditions in discrete portion of several cells with heat accumulation involving the following: planning and assessment for ETLF landfill reaction characterization and remedial strategies; negotiating Stipulated Order of Consent with regulatory agency; field sampling and lab analysis of gas and leachate within landfill reaction area; engineering design and construction quality assurance (CQA) of landfill gas collection system and liquids management system; permitting and engineering design of segregated landfill gas blower/TOX/flare control system; landfill gas system operations & maintenance support; conceptual planning and design for an interim exposed geomembrane cap; data analysis; air quality and solid waste permitting and regulatory compliance reporting/recordkeeping; odor monitoring, mitigation, abatement, and control plan; community engagement, public communications, and outreach.

Elevated Temperature Landfill Presentations

- "Identifying and Managing Elevated Temperature Landfills." SCS Engineers Webinar, July 27, 2023.
- "Examination of Commonly Encountered ETLF Issues & Corresponding Engineered Solutions." SCS Engineers Landfill Gas/Landfill Guru Meetings, Atlanta, GA, April 16, 2023.
- "Assessing, Monitoring, Managing, & Mitigating ETLF Conditions: 7 Categories of Considerations." SCS Engineers Landfill Gas/Landfill Guru Meetings, Atlanta, GA, April 15, 2023.
- "Odor Mitigation Strategies for Landfills." Association of State & Territorial Solid Waste Management Officials (ASTSWMO) Joint Hazardous Waste & Materials Management Training, Milwaukee, WS, August 19, 2019.
- "Elevated Temperature Landfills." SCS Engineers Landfill and Solid Waste Seminar, Charlotte, NC, October 2018.
- "Engineering Design Issues at ETLF Landfill Gas Systems." SCS Engineers Landfill Gas/Landfill Guru Meetings, North Charleston, SC, April 2, 2016.
- "Elevated Temperature Landfill Design Considerations." SCS Engineers Landfill and Solid Waste Seminar, Charlotte, NC, October 9, 2015.
- "Elevated Temperature Landfills." WasteExpo, Las Vegas, NV, June 3, 2015.
- "Elevated Temperature Landfills." SCS Engineers Landfill and Solid Waste Seminar, Richmond and Roanoke, VA, May 28 and 29, 2015.
- "Elevated Temperature Landfills." SCS Engineers Landfill and Solid Waste Seminar, Baltimore, MD, May 21, 2015.

PATRICK S. SULLIVAN, BCES, CPP, REPA

Education

BA – Harvard University, Biology/Ecology, 1989

Professional License/Certifications

Board Certified Environmental Scientist, No. 15-ES009, American Academy of Environmental Engineers & Scientists (AAEES)
South Coast Air Quality Management District (SCAQMD), Certified Permitting Professional (No. A-1716)
Registered Environmental Property Assessor, No. 519692, National Registry of Environmental Professionals (NREP)
Approved Lead Verifier under California Air Resources Board (CARB) AB 32 Greenhouse Gas (GHG) Program, Executive Order H-21-130

Selected Professional Affiliations

Air and Waste Management Association (AWMA); Chairman, Mother Lode Chapter
Waste Industry Air Coalition (WIAC), Co-Chairman
Solid Waste Industry for Climate Solutions (SWICS), Co-Chairman
Research Associate, Columbia University, Earth Engineering Center for Sustainable Waste Management
Solid Waste Association of North America (SWANA), Biogas Division, Previous Chairman
Technical Advisory Group; Cal Recycle, Landfill Gas (LFG) Rulemaking
Technical Advisory Group, CARB, AB 32 Landfill Methane Rule
Rulemaking Advisory Committee (RAC) Oregon Department of Environmental Quality (ODEQ), LFG
Society for Risk Analysis

Professional Awards

Distinguished Individual Achievement Award, LFG/Biogas Division, SWANA, 2019
Certificate of Excellence, Publication of over 100 Articles and Presentation, SCS Engineers (SCS), 2015
Distinguished Service Award, National Solid Waste Management Association (NSWMA, now National Waste and Recycling Association, NWRA), 2009
Hall of Flame, SWANA, LFG/Biogas Division, 2007

Professional Experience

Mr. Sullivan has over 33 years of experience in the area of environmental engineering, specializing in solid waste management. He is the Managing Director of SCS's consulting and engineering operations within the Southwestern United States. He also serves as the Practice Leader for SCS's Solid Waste Practice in the same region. Mr. Sullivan is the National Expert for SCS's companywide Clean Air Act (CAA) programs. He is one of the national experts on air quality, landfill gas, odor, and risk assessment and toxic exposure analyses for solid waste facilities. Mr. Sullivan is a company Senior Vice President and a Member of the Company's Management Advisory Committee.

Mr. Sullivan is the Principal-in-Charge for projects related to air quality permitting and compliance, LFG engineering and compliance, risk assessment, and odor as well as related engineering services. Mr. Sullivan has published and/or presented over 150 technical papers and/or presentations in industry journals, publications, conferences, seminar, and workshops. Because of this expertise, Mr. Sullivan has been involved with the following practices and projects:

Air Quality

Title V Permit Applications and Documentation. Mr. Sullivan has been involved with over 200 Title V permitting projects, including Title V compliance reporting for over 100 facilities, for solid waste and industrial facilities.

New Source Review (NSR)/Prevention of Significant Deterioration (PSD) Permit Applications and Documentation. Mr. Sullivan has been involved with over 100 NSR/PSD projects for various types of solid waste and industrial facilities. This includes permitting for over 30 landfill expansions, 20 composting projects, 25 LFG to energy projects, and various industrial facilities.

New Source Performance Standard (NSPS) Compliance Activities. Mr. Sullivan has overseen the completion of NSPS Tier 1 and 2 emission rate studies and reports, LFG collection and control system (GCCS) design plans, surface emission monitoring plans, and other documentation for over 200 landfills under the landfill NSPS program, including compliance reporting for over 85 landfill sites. In addition, Mr. Sullivan has worked on NSPS compliance activities for various other sources, including boilers, incinerators, engines, turbines, chemical manufacturing, hazardous waste facilities, and various others.

National Emission Standards for Hazardous Air Pollutants (NESHAPs) Compliance Activities. Mr. Sullivan has been involved with over 100 NESHAPs projects for various regulated sources, including development of Startup, Shutdown, and Malfunction (SSM) plans and various other compliance documents.

Development and Teaching of Training Courses for Air Quality Compliance at over 50 Seminars. Compliance and regulatory issues that have been taught included Title V, NSPS, NESHAPs/MACT, NSR/PSD, GHG reporting and permitting, and related state and local requirements.

Regulatory Advocacy for the Solid Waste Industry where landfills or other solid waste facilities are included as a regulated source. Mr. Sullivan has developed industry comments and negotiated with the agencies on behalf of the industry as it related to the NSPS/NESHAPs rules, Title V operating permit programs, GHG programs, LFG regulations, and other regulations, .

Preparation of Numerous Local Air District, State, and Federal Air Permitting Documents for the installation of air pollution control devices and industrial equipment, including engines, turbines, carbon adsorption systems, boilers, cooling towers, air strippers, wastewater treatment plants, biogas collection systems and flares, biogas recovery plants, and various industrial systems. Mr. Sullivan has managed over 250 state or local air permitting projects for landfills and industrial facilities.

Permitting, Compliance, and Due Diligence Projects for Renewable Energy Projects throughout the United States. Mr. Sullivan has completed technical and financial due diligence for over 50 existing and proposed projects, as well as permitting and compliance activities for over 75 facilities. Some of these projects have also included registration of GHG credits, facilitation of trades for GHG credits, renewable energy credits, and development of methodologies for estimation of GHG reductions as well as all of the air quality permitting tasks. Mr. Sullivan has permitted over 30 biogas to energy plants across the country.

Air Quality Modeling and Risk Assessment for Permitting or Environmental Impact Reports (EIRs) for approximately 50 landfill expansions, new landfills, composting facilities, transfer stations, other solid waste facilities, and various commercial/industrial projects in California, including evaluations of health risks, ambient air quality, GHG, and/or odors. This has included the preparation of a variety of California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) documentation. He has completed air dispersion modeling and risk assessments for over 100 permitting projects or as part of state air toxic programs.

Air Sampling and Source Testing for Various Emitting Devices, including sampling for volatile organic compounds (VOCs), criteria pollutants, particulate heavy metals, and asbestos fibers. Completion of all air sampling associated with asbestos abatement. Mr. Sullivan has also provided oversight of source testing at over 100 landfill sites and development of a database of landfill source tests for use in the work of the WIAC.

Air Permitting. Mr. Sullivan has completed air permitting and compliance activities for the following types of industrial facilities:

- Solid waste incinerators.
- Biomass energy plants.
- Landfills.
- Recycling facilities and transfer stations.
- Composting facilities.
- LFG recovery plants.
- Cement and asphalt plants.
- Chemical manufacturing facilities.
- Aerospace facilities.
- Jewelry manufacturing facilities.
- Sand and gravel facilities.
- Electronics facilities.
- Site remediation projects.
- Paint and solvent manufacturing plants.
- Boat manufacturing plants.

Completed Landfill Air Quality Services in the Following States and Air Districts: SCAQMD, San Joaquin Valley Air Pollution Control District (SJVAPCD), Bay Area AQMD (BAAQMD), Sacramento Metropolitan AQMD, San Diego County APCD, Yolo-Solano AQMD, Feather River AQMD, Kern County APCD, Ventura County APCD, Santa Barbara County APCD, Shasta County APCD, Antelope Valley APCD, Mojave Desert AQMD, Placer County APCD, North Coast Unified AQMD, Butte County APCD, Monterey Bay Unified APCD, Lake County AQMD, and El Dorado County APCD. States of Nevada, Oregon, Washington, Hawaii, Arizona, Idaho, Montana, New Mexico, Colorado, Utah, Texas, Ohio, Pennsylvania, Florida, Arkansas, Illinois, Kansas, Virginia, Oklahoma, Tennessee and several others. County or local agencies in Nevada, Arizona, and Washington.

Landfill Gas

Mr. Sullivan has been involved with over 125 LFG planning or engineering projects; several examples are provided below.

Principal in Charge for Design, Bidding Support, and Construction Oversight for LFG Collection and Control System, Highway 59 Landfill, Merced County, CA. The system was originally designed to prevent LFG migration and provide corrective action for groundwater impacts. The system

successfully remediated LFG migration and brought the facility in compliance with Resource Conservation and Recovery Act (RCRA) Subtitle D requirements. The LFG system was subsequently upgraded to meet NSPS and California AB 32 requirements. Currently, Mr. Sullivan oversees the operations and maintenance (O&M) of the LFG system as well as all air, GHG, and LFG compliance and permitting services.

Principal in Charge, Completion of Various LFG Engineering and Construction Oversight and Groundwater Services, Various WM Landfills. Landfill sites included Bradley, Simi Valley, Columbia Ridge, DADS, Lancaster, Redwood, Lockwood, Antelope Valley, Rio Rancho, Butterfield, Riverbend, Hillsboro, Anderson, Northwest Regional, and El Sobrante. Engineering tasks have included design of wellfield expansions, new blower/flare stations, header upgrades and replacements, groundwater monitoring and reporting, groundwater corrective action plans, as well as a variety of air quality services. These projects are generally completed on a design-build basis.

Principal in Charge, Completion of LFG Planning and Engineering for Various Republic Services' (Republic's) Landfills. Landfill sites included Otay, Sycamore, Imperial, Vasco Road, West Contra Costa Sanitary, Forward, Chateau Fresno, Sonoma Central, Foothills, Tower Road, ECDC, Ox Mountain, Wasatch, Apex, and Sunshine Canyon Landfills. Engineering tasks have included design of wellfield expansions, new blower/flare stations, and header upgrades and replacements as well as CQA. Under SCS's direction, SCS upgraded Republic's LFG Master Plans and prepared LFG remediation plans to address LFG migration issues. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality tasks for the projects. SCS has completed design-build services for the LFG systems on several of these sites.

Principal in Charge, Completion of LFG Planning and Engineering for Various Waste Connections, Inc.'s (WCI's) Landfills. Landfills have included Chiquita Canyon, Fairmead, Potrero Hills, Cold Canyon, John Smith Road, LRI, and Avenal Landfills. Engineering tasks have included design of wellfield expansions, new blower/flare stations, and header upgrades and replacements, as well as CQA. SCS has upgraded WCI's LFG Master Plans and developed long-term cost estimates for LFG system expenditures. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality tasks for the project. SCS has completed design-build services for some of the LFG systems on these sites.

Principal in Charge, Various Other LFG Planning or Engineering Projects throughout California, Oregon, and Colorado, including Stanislaus County's Geer and Fink Road Landfills, Butte County's Neal Road Landfill, Sunnyvale Landfill, L&D Landfill, Sacramento County's Kiefer Landfill, Madera County's Fairmead Landfill, Yolo County's Central Landfill, Clovis Landfill, City of San Diego's Miramar Landfill, County of San Diego's Hillsborough and Bell Junior High School Landfills, as well as various other smaller closed landfill sites. Many of these projects included planning, engineering design, bid support, CQA, and/or design-build of LFG system expansions.

CEQA/NEPA Analyses

Examples of Mr. Sullivan's project work on CEQA and EIR projects are detailed below.

CEQA Air Quality Analysis and Toxics Risk Assessment, Proposed Expansion to Fink Road Landfill, Stanislaus County, CA. As part of an EIR for a proposed expansion to the Fink Road Landfill in Stanislaus County, CA, SCS completed an air toxics risk assessment, which evaluated the potential human health impacts due to current and future exposures from the project. The risk assessment was part of a larger air quality analysis completed for the expansion EIR. The analysis included an evaluation of health risk due to diesel exhaust from heavy equipment and refuse hauling vehicles at

the landfill. As part of this project, SCS also researched the conversion of refuse hauling fleets to alternative fuels in order to generate ERCs for CEQA mitigation measures.

CEQA Air Quality Analysis and Toxics Risk Assessment, Salinas Valley Solid Waste Authority Landfill Project, Monterey County, CA. SCS completed air quality and risk assessment sections of a large EIR being prepared for long-term refuse collection and disposal options for the Salinas Valley Solid Waste Authority's Regional Landfill Project. The project included three landfills and 10 transfer stations, which were combined into four different project scenarios. The project included emissions estimates, air dispersion modeling, and risk calculations. The analysis included an evaluation of health risk due to diesel exhaust from heavy equipment and refuse hauling vehicles at the landfills and transfer stations, which were part of the project.

CEQA Mitigation Measures Development and Implementation for El Sobrante Landfill, Corona, CA. SCS was enlisted to develop a series of mitigation measures for fugitive dust emissions from landfill construction and operations at the El Sobrante Landfill in Corona, CA. SCS also developed an implementation plan for the CEQA Mitigation Monitoring and Reporting Program (MMRP), which was required as part of the approval of the EIR. SCS is currently doing ambient monitoring for particulate matter less than 10 microns (PM10) levels and working with the SCAQMD to develop a long-term strategy to reduce dust emissions.

CEQA Air Quality Analysis and Toxics Risk Assessment Proposed Expansion to Newby Island Sanitary Landfill, Santa Clara County, CA. As part of an EIR for a proposed expansion to the Newby Island Sanitary Landfill in Santa Clara County, CA, SCS completed an air quality impact analysis that included a risk assessment evaluating the potential human health impacts due to current and future exposures to contaminants from the project. The risk assessment was part of a larger air quality analysis completed for the expansion EIR. The project included emissions estimates, air dispersion modeling, GHG evaluation, and risk calculations.

Risk Assessment

The following are examples of projects where Mr. Sullivan has worked on landfill investigation and/risk assessment projects.

Landfill Investigation, LFG Engineering, Human Health Risk Evaluation and Impact Assessment, Proposed Residential Developments, Adjacent to the Otay Landfill, Chula Vista, CA. Project activities at the site have included an evaluation of LFG migration, LFG engineering and testing, air quality permitting and compliance, soil and LFG sampling and analysis, human health risk assessment and nuisance/odor evaluation, CEQA assistance, operations and maintenance of the LFG collection and control system, and other landfill engineering and construction services. The risk assessment and odor/nuisance analysis was completed to support residential development adjacent to the landfill.

Environmental Investigations and Risk Assessment at the Former BKK Main Street Landfill in Los Angeles County. This landfill is a closed site that may have received both hazardous and non-hazardous wastes; it is currently occupied by two golf courses and other commercial and residential developments and is being considered for additional redevelopment. Project work at this facility has included completion of soil vapor surveys, installation and monitoring of LFG migration probes, LFG sampling/analysis, oversight of cover and subsurface soil and groundwater sampling, completion of a human health risk assessment, CEQA assistance, and negotiations with regulatory agencies. The site is currently being considered for listing on the National Priorities List (NPL) as a potential Superfund site. Oversight of the landfill is provided by EPA Region IX, Department of Toxic Substance Control (DTSC), and the Los Angeles County landfill local enforcement agency (LEA).

Human Health Risk Evaluation and Impact Assessment, Proposed Commercial Developments, On and Adjacent to the BKK Landfill Site, West Covina, CA. The BKK site includes two landfills: one municipal solid waste landfill and one hazardous waste site, which are under the oversight of DTSC. Mr. Sullivan provided oversight for the completion of various investigations and data reviews/analyses of soil, surface water, groundwater, LFG, and air quality. The data were used for the completion of a human health risk assessment in support of the CEQA process for a proposed golf course and business park development on the Class III landfill.

Investigation, Risk Assessment, and Remediation Kaiser Ventures, Inc., Facilities, Fontana, CA. For the former Kaiser Steel plant in Fontana, Remedial Investigation (RIs)/Feasibility Studies (FSs), Remedial Action Plans (RAPs), and Remedial Designs were prepared for three on-site operable units under DTSC's oversight. Mr. Sullivan was responsible for a number of individual soil, groundwater, surface water, and waste investigations at the Kaiser site, including treatability studies, risk assessments, RAPs, and hydrogeological studies, storm water pollution prevention plans, and spill prevention, control, and countermeasure (SPCC) plans. These projects included investigations of two landfill sites, with both hazardous and non-hazardous wastes, including soil, waste materials, hazardous waste, groundwater, and surface water issues. The site has been redeveloped into the California Speedway, a NASCAR race track.

Investigation, Risk Assessment, and Remediation Feasibility Study, Mission Bay Landfill, San Diego, CA. For this site, Mr. Sullivan managed a significant forensic investigation and site assessment of the former landfill site, which is located next to a river, bay, and amusement park and is used heavily for recreational purposes. This work has included investigations of extent of refuse, cover thickness, LFG composition and migration, soil, surface water, groundwater, and other environmental media associated with Mission Bay. The field investigations will be followed by a risk assessment, and, given the highly visible and public nature of the landfill project, focus on risk communication will be of primary importance. Ultimately, several candidate risk-based remediation methods applicable to the site will be identified with typical costs associated with each method. This project included interface with the San Diego County APCD, RWQCB, LEA, and DTSC.

Landfill Engineering, LFG Migration Assistance, and Human Health Risk Assessment, Geer Road Landfill, Modesto, CA. Mr. Sullivan has managed and been involved with a variety of projects at the Geer Road site, including closure design and CQA services, cover repair, LFG engineering, air quality compliance, human health risk assessment, LFG system O&M, LFG and groundwater monitoring, as well as acted as an expert witness in defending the landfill against a citizen lawsuit. Project work was under the jurisdiction of the landfill LEA and RWQCB.

Odor Evaluations

Mr. Sullivan has been involved with a variety of odor-related projects as summarized below.

Republic Services, Odor Analysis, Santa Clara County, CA. Pat completed an odor analysis for an MSW landfill expansion composting facility, and wastewater treatment plant in Milpitas, CA.

Waste Connections, Odor Analysis, Kings County, CA. Pat completed an odor analysis for an MSW landfill expansion in Kings County, CA.

WM, Odor Analysis and Air Quality Services, Livermore and Novato, CA. Pat provided services that included an odor analyses and air quality services for landfills and composting facilities located in Livermore and Novato, CA.

Recology, Odor Analysis and Air Quality Services, Vacaville, CA. Pat provided services that included an odor analyses for a landfill and composting facility in Vacaville, CA.

Republic Services, Odor Analysis and Air Quality Services, Richmond, CA. Pat provided services that included an odor analyses for a landfill and composting facility in Richmond, CA.

Waste Connections, Odor Analysis and Air Quality Services, Avenal, CA. Pat provided services that included an odor analyses for a landfill in Avenal.

County of Mariposa, Air Quality and Odor Analysis, Mariposa, CA. Pat provided analysis services for a proposed municipal solid waste (MSW) composting operation in Mariposa County, CA.

Western Placer Waste Management Authority (WPWMA), Air Quality and Odor Analysis, Lincoln, CA. Pat was involved with services that included ambient air testing and air dispersion modeling for an odor study, for MSW landfill, composting facility, and materials recovery facility (MRF) in Placer County, CA.

WM Odor Analysis, San Bernardino, CA. Pat provided odor services for a proposed MRF in San Bernardino County, CA.

Confidential Client, Development of Expert Report and Review, Adelanto, CA. Pat provided analysis of the opposing experts' work on air quality and odor analyses of a composting facility in Adelanto, CA.

City of San Diego, Air Quality and Odor Analysis, San Diego, CA. Pat provided services that included ambient air testing and air dispersion modeling for an odor study, an MSW landfill, wastewater treatment plant, and composting facility in San Diego, CA.

Confidential Client, Compliance Review and Odor/Air Quality Impact Assessment, San Diego, CA. Pat provided services for an existing composting operation in San Diego, CA, which is adjacent to a proposed residential development.

Republic Services, Air Quality and Odor Analysis, Chula Vista, CA. Pat provided services that included air dispersion modeling and odor impact analysis for an MSW landfill in Chula Vista, CA.

Feasibility Analysis, Best Available Control Technology (BACT) Cost-Effectiveness Analysis, and Hydrogen Sulfide Testing for the evaluation of sulfur removal technologies as odor control for LFG-derived odors for 15 landfill sites.

Odor analyses as part of the air quality sections of over 15 EIRs for landfill expansions.

Litigation Support

Mr. Sullivan has extensive litigation support and expert witness experience as summarized below.

Litigation Support and Preparation of Expert Report in Defense of a Landfill Company in Pittsburgh, PA, which was sued under the third-party provisions of the federal CAA. Project tasks including emissions estimation, regulatory applicability review, and preparation of an expert report. The case was settled in favor of our client.

Litigation Support as part of a CERCLA Cost Recovery Action Filed by a Group of PRPs against Various Municipalities and Public Agencies that Disposed Refuse at a Mixed Hazardous and Municipal Solid Waste Landfill in California. Project tasks included review of depositions, evaluation of industrial and hazardous waste disposed in the landfill, and development of a draft report on the contribution of the various potentially responsible parties (PRPs) to contamination in the landfill. Our clients were successful in the litigation.

L**itigation Support and Expert Testimony as Part of a Toxic Tort Litigation Filed by a Local Residence Against a County-owned Closed Landfill in Modesto, CA.** Project tasks included a site investigation, risk assessment, groundwater evaluation, and expert testimony (deposition and trial). The case was settled with minimal damages for our client.

Litigation Support and Expert Testimony as Part of a Toxic Tort Litigation Filed by a Local Residence against a County-owned Active Landfill in Merced, CA. Project tasks included a LFG assessment, site investigation, risk assessment, groundwater evaluation, and expert testimony (deposition and trial). The case was ruled in favor of our client.

Litigation support for a defendant in a Proposition 65 lawsuit concerning the exposure to various pollutants emitted from landfills and other solid waste facilities in California (six total facilities).

Recent Landfill Expert Witness Experience

Crane, et al., v. County of Merced. LFG migration and exposure/risk assessment case. Expert report, deposition, and trial testimony. Our client was successful in the litigation.

Brian Kahn v. The Dewey Group. LFG exposure/risk assessment case. Expert report, deposition, and trial testimony. Our client was successful in the litigation.

Tommy McCarty, et al., v. Oklahoma City Landfill, LLC. LFG emission and odor case. Expert report and deposition. Our client was successful in the litigation.

Peter Ng, et al., v. International Disposal Corporation of California. LFG emission and odor case. Expert report and deposition. Our client was successful in the litigation.

Republic Services, Inc., v. Fortistar, Inc. Dispute over LFG rights and the loss of royalties for undeveloped LFG resources. Expert report. Litigation settled in favor of our client.

Eklutna v. Municipality of Anchorage. Dispute over LFG rights and the value of the LFG resource. Expert affidavit. The litigation was settled amicably for both parties.

Yeshayahu Michaely, et al., v. Browning Ferris Industries of California, Inc., et al. LFG emission and odor case. Expert report and deposition. Our client was successful in the litigation.

Timberline Energy, LLC, v. Waste Connections of Kansas, Inc. LFG carbon credits dispute. Expert report. Litigation settled favorably for our client.

Thomas and Marie Dickens, Sharon Kay, and Jim Howe, v. King County, Washington. LFG emission and odor case. Expert report, deposition, and trial testimony. The court decision was very favorable to our clients.

Decatur County, Tennessee v. Waste Industries of Decatur. LFG emissions and odor case. Expert report and deposition. The case was settled positively for our client.

Bituminous Resource (D/B/A: Hopkins County Regional Landfill) v. Commonwealth of Kentucky, Energy and Environmental Cabinet. Air quality and regulatory compliance. Expert report and declaration. Our client was successful in the litigation.

Home Fed vs. Otay Landfill, Inc. LFG migration and exposure/risk assessment case. Expert report, deposition, and trial testimony. The case is ongoing.

Greenhouse Gas

Mr. Sullivan has participated in the following GHG projects while at SCS.

CARB, Approved Lead Verifier or Internal Senior Reviewer

- Alameda Municipal Power[1]
- Biggs Municipal Utility[1]
- Cal Portland Company – Mojave Plant[2]
- Cal Portland Company – Colton Plant[2]
- California Steel Industries
- City of Lompoc[1]
- City of Roseville, CA[1]
- City of Ukiah, Electric Utilities Division[1]
- City of Victorville[1]
- Collins Pine Company
- Corn Products
- Georgia Pacific
- Gridley Electric Utility[1]
- Healdsburg Electric Department[1]
- Hilmar Cheese Company
- Imperial Irrigation District[1]
- Imperial Irrigation District – Coachella Gas Turbines
- Imperial Irrigation District – El Centro Generating Station
- Imperial Irrigation District – Niland Gas Turbines Plant
- Imperial Irrigation District – Rockwood Gas
- JP Morgan Chase Bank[1]
- Kinergy[1]
- Lodi Electric Utility[1]
- Metropolitan Water District[1]
- Orange County Sanitation District
- Pacific Ethanol[1]
- Port of Oakland[1]
- Port of Stockton, CA[1]
- Riverside Wastewater Treatment Plant
- San Francisco Hetch Hetchy Water & Power[1]
- Truckee Donner Public Utility District[1]
- Temple-Inland
- University of California at Davis
- University of California at Irvine
- University of California at Santa Cruz
- University of California at San Diego
- Western Area Power Authority[1]

[1] Verification includes electrical/fuel transactions.
[2] Verification included process emissions (landfill, wastewater treatment, geothermal, or other process emissions).
[3] Verification includes oil and gas emissions.

Climate Action Reserve GHG Project Reduction Services

Landfill and Organic Waste Composting Protocols

- Dalton-Whitfield Regional Solid Waste Management Authority
- L & D Landfill
- Larimer County Landfill Electric Generation Project
- Hay Road Landfill Feasibility Study
- Montana-Dakota Utilities Billings Landfill
- YSDI Landfill Feasibility Study Central Landfill, Citrus County, Florida
- Raleigh County Solid Waste Authority
- Pendleton County Landfill
- Eagle Point, Wolf Creek, and Stones Throw Landfills Project
- Organic Waste Composting Protocol
- American Organics OWC
- Grover Environmental Products
- Jepson Prairie Organics
- South Valley Organics

AB32 Mandatory Reporting. Completed State of California Mandatory GHG reporting under AB32 for the following general stationary combustion facilities:

- Altamont Landfill
- Bradley Landfill
- CalEnergy Geothermal Plants
- City of Fresno Wastewater Treatment Plant
- El Sobrante Landfill
- G2 Ostrom Road
- Kirby Canyon Landfill
- Mid-Valley Landfill
- Penrose Landfill Gas Conversion, LLC
- Redwood Landfill
- San Bernardino County Solid Waste Mgmt. - MVSL
- Simi Valley Landfill
- Sunnyvale WWTP
- Toyon Landfill Gas Conversion, LLC

GHG Compliance for Landfills. Completed GHG compliance services for over 100 landfills related to the AB32 mandatory reporting rule, AB32 landfill methane rule, and federal "Tailoring" rule for GHG.

U.S. EPA GHG Reporting Rule. Management and oversight for over 500 U.S. EPA GHG mandatory reporting rule projects for landfills and industrial facilities.

GHG Emissions Inventory and Verification of Creditable GHG Reductions. Performed GHG emissions inventory services, verification of creditable GHG reductions, and development of GHG management plan under CEQA for Kern County Waste Management Department, California.

GHG Consulting for Municipalities. Provided GHG consulting services for Sacramento County, Los Angeles County, City of Carlsbad, City of Alameda, and the City of Palo Alto.

GHG Emissions Inventory and Certification of Donated GHG Reductions (to make event GHG neutral), Super Bowl, Houston, TX and Winter Olympics, Salt Lake City, UT.

SWICS Group. Involvement with the leadership of the SWICS group. As part of this effort, Mr. Sullivan has developed protocols for landfill GHG emission estimates and led SWICS advocacy efforts on the proposed AB32 early action rule for landfills, cap and trade, as well as the AB32 and federal GHG mandatory reporting rules.

Private Waste Company GHG Consulting. Provided GHG consulting for all of the large private waste management companies.

Development of GHG Guidance Document. Developed the guidance document titled, "Technologies and Management Options for Reducing Greenhouse Gas Emissions from Landfills," under contract to the California Integrated Waste Management Board (CIWMB).

Relevant Publications and Presentations

Sullivan, Patrick S. and Huff, Raymond H., *The Evolution of Methane Emissions Measurements at Landfills: Where are We Now?,* Paper and Presentation at A&WMA's 115th Annual Conference & Exhibition, June 2022.

Sullivan, Patrick S., A Comparison of: Landfill Methane Rules in California and Oregon, Presented virtually at SWANA Mid-Atlantic Chapter's 2022 Conference, June 2022.

Sullivan, Patrick S., Weighing Waste Management Options, Waste 360, June 2022.

Sullivan, Patrick S., The Evolution of Emission Controls on Landfill Gas Engines and Turbines, Presented during the Virtual EUEC 2021 Conference, August 2021.

Sullivan, Patrick S., Comparison of Organic Waste Management Options in Terms of Air Quality and GHG Impacts, Presented at Waste Expo Together On-Line, August 2021.

Sullivan, Patrick S., Wading through the Confusion EPA Has Created with New NSPS/EG and NESHAPs Rules, SWANA Western Regional, On-Line Webinar, November 2020.

Sullivan, Patrick S., The Evolution of Emission Controls on Landfill Gas Engines and Turbines, Presented during the Virtual EUEC 2020 Conference, April 2020.

Sullivan, Patrick S., What to Do with Organic Waste, Published in Waste Today, November/December 2020.

Sullivan, Patrick S.; Wuestenberg, Niki; and Stutz, Matt, Major Developments in Solid Waste Facility Regulations, Panel Discussion at SWANA Wastecon, Phoenix, Arizona, October 2019.

Sullivan, Patrick S., and Colline, Christian, The Evolution of Emission Controls on Biogas Engines: When Technology and Regulations Collide, A&WMA Webinar, June 2019.

Sullivan, Patrick S., Regulatory Update: New and Revised Air/GHG Regulations Affecting Solid Waste Facilities, Presentation at SWANA Western Regional Symposium, Yosemite, California, April 2019.

Sullivan, Patrick S., Health Risk Assessment Issues for Landfills, SWANAPalooza, Boston, Massachusetts, February 2019.

Sullivan, Patrick S., and Henkelman, John, Understanding Landfill Gas Monitoring Techniques, Waste Today, January/February 2019.

Sullivan, Patrick S., and Drotman, Cassandra, Tier 4 Surface Emissions Monitoring Process and Issues, Publication in the Proceedings for the A&WMA's 111th Annual Conference & Exhibition, Hartford, Connecticut, June 2018.

Sullivan, Patrick S., Regulatory Update: Alternatives to Daily Soil Cover from an Emissions Standpoint, Presentation at SWANA Western Regional Symposium, Palm Springs, California, May 2018.

Sullivan, Patrick S., Odor Management at Solid Waste Facilities: Proactive not Reactive, SWANA eLearning Webinar, May 2018.

Sullivan, Patrick S., Cleaner Air Oregon Program, Panel Discussion, SWANA Northwest Regional Symposium, Troutdale, Oregon, April 2018.

Sullivan, Patrick S., Managing Odors at Composting and Other Organics Facilities, Presentation at Waste Expo 2018, Las Vegas, Nevada, April 2018.

Sullivan, Patrick S., et al., Evolving Landfill Air Regulations, Presentation and Panel Discussion, SWANAPalooza, Denver, Colorado, March 2018.

Sullivan, Patrick S., et al., Evolving Landfill Air Regulations, Presentation and Panel Discussion, Global Waste Management Symposium, Indian Wells, California, February 2018.

Sullivan, Patrick S., Huff, Raymond H., and Henkelman, John, Causes of Increasing Sulfur Content in California Landfill Gas, Proceedings of the Global Waste Management Symposium, Indian Wells, California, February 2018.

Sullivan, Patrick S., The Challenge in Redeveloping Landfills, Published in the San Diego Daily Transcript, December 2017.

Sullivan, Patrick S., Sniffing for Answers, Odor Management Series, Waste Today magazine, November/December 2017 Issue.

Sullivan, Patrick S., Battle of the Stink, Odor Management Series, Waste Today magazine, September/October 2017 Issue.

Sullivan, Patrick S., et al., Air Quality and GHG Regulatory Update for U.S. Landfills, Panel Presentation at SWANA WASTECON Conference, Baltimore, Maryland, September 2017.

Sullivan, Patrick S., Huff, Ray, Drotman, Cassandra, and Henkelman, John, Potential Use of NSPS and GHG Reporting Program Data to Calculate GHG Reductions, Publication in the Proceedings for the A&WMA's 110th Annual Conference & Exhibition, Pittsburg, Pennsylvania, June 2017.

Sullivan, Patrick S., Odor Management Strategies for Organics Processing, Presentation at SWANA Gold Rush Chapter, It's All About Organics Workshop, San Jose, California, June 2017.

Sullivan, Patrick S., et al., Regulatory Update: What about XXX and Cf Landfills? Panel Discussion at Waste Expo 2017, New Orleans, Louisiana, May 2017.

Sullivan, Patrick S., Part 2. Key Issues with New NSPS and EG rules for Landfills, Presentation at SWANA Northwest Regional Symposium, Tulalip, Washington, April 2017.

Sullivan, Patrick S., How to Deal with Odor Issues that Rear Their Ugly Heads at Solid Waste Facilities, Presentation at SWANAPalooza 2017, Reno, Nevada, March 2017.

Sullivan, Patrick S., et al., How Sweeping Changes to the NSPS Impact Your Facility, Panel Discussion at SWANAPalooza 2017, Reno, Nevada, March 2017.

Sullivan, Patrick S., New Rules for Landfills, Published in MSW Management magazine, November/ December 2016.

Sullivan, Patrick S., Federal and California Landfill Emissions Regulatory Updates, Presentation at Rural Counties ESJPA Technical Advisory Meeting, October 2016.

Sullivan, Patrick S., Summary of New NSPS and EG Rules for Landfills, SCS Webinar, September 2016.

Sullivan, Patrick S., et al., The Final Outcome: Summary of NSPS and EG Rules for Landfills, Panel Presentation at SWANA WASTECON Conference, Indianapolis, Indiana, August 2016.

Sullivan, Patrick S., The Impact of the NSPS Rule for Landfills, Panel Discussion at Waste Expo 2016, Las Vegas, Nevada, June 2016.

Sullivan, Patrick S. and Drotman, Cassandra, Impact on the Waste Industry from Proposed EG and Supplemental NSPS Rules for Landfills, A&WMA's 109th Annual Conference & Exhibition New Orleans, Louisiana, June 2016.

Sullivan, Patrick S., Rules and Regulations Update – Industry Impacts from the New NSPS Rule for MSW Landfills, Panel Discussion at SWANAPalooza 2016, Charleston, South Carolina, April 2016.

Sullivan, Patrick S., Regulatory Update: Air/GHG Regulations, Presentation at SWANA Western Regional Symposium, San Luis Obispo, California, April 2016.

Sullivan, Patrick S., Odor Management at Solid Waste Facilities, Presentation at Dinner Meeting, Mother Lode Chapter, A&WMA, March 1, 2016.

Sullivan, Patrick S., and Huff, Raymond H., Evaluating Impacts from Landfill Gas in a Litigation Setting, Proceedings of the Global Waste Management Symposium, Indian Wells, California, February 2016.

Sullivan, Patrick S., Evaluating Impacts from LFG in a Litigation Setting, Presentation at SWANA Webinar, December 16, 2015.

Sullivan, Patrick S., et al., Changes Proposed to NSPS and EG Rules for Landfills, Published in Waste Advantage magazine, Volume 6, Number 11, November 2015.

Sullivan, Patrick S., et al., LFG Rules and Regulations Committee Update, Panel Presentation at SWANA WASTECON Conference, Orlando, Florida, August 2015.

Sullivan, Patrick S., Comparison of Air Quality and GHG Benefits/Impacts for Organic Waste Diversion Options, Presentation at Waste Expo, Las Vegas, Nevada, June 2015.

Sullivan, Patrick S., et al., A Landfill Game Changer, Published in MSW Management Magazine, March/April 2015.

Sullivan, Patrick S., Air and GHG Regulatory Update, Presentation at the 38th Annual SWANA Landfill Gas Symposium, New Orleans, Louisiana, March 2015.

Sullivan, Patrick S., Regulatory Aspects Affecting LFG Management, Presentation at Environmental Research and Education Foundation (EREF) Regional Summit, Austin, Texas, November 2014.

Huff, Ray, H., and Sullivan, Patrick S., Air Compliance Hurdles and Necessary Regulatory Flexibility for Landfill Gas System Compliance When Managing Subsurface Reactions, Published in the Proceedings of the Global Waste Symposium, Orlando, Florida, June 2014.

Walker, Scott, and Sullivan, Patrick S., California Landfill Methane Control Efficiency Based on Recent Direct Measurement Studies, Published in the Proceedings of the Global Waste Symposium, Orlando, Florida, June 2014.

Sullivan, Patrick S., et al., Update on Federal Air and GHG Regulations Affecting Landfills, Published in Waste Advantage magazine, Volume 5, Number 3, March 2014.

Sullivan, Patrick S., et al., Lessons Learned from California Landfill Methane Rule Reporting, Presentation at the 37th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2014.

Sullivan, Patrick S., et al., LFG Rules and Regulations Committee Update, Panel Presentation at SWANA WASTECON Conference, Long Beach, California, September 2013.

Sullivan, Patrick S., Why Won't They Just Stop? More Changes to the Air and GHG Regulations for Landfills, 42nd Annual SWANA Western Regional Symposium, San Luis Obispo, California, April 2013.

Sullivan, Patrick S., et al., Lessons Learned from the First Two Years of Compliance with the Federal GHG Mandatory Reporting Rule, Paper and Presentation for 36th Annual SWANA Landfill Gas Symposium, Las Vegas, Nevada, March 2013.

Sullivan, Patrick S., et al., Defending Landfills Accused of Landfill Gas Impacts on Neighboring Properties, Paper and Presentation for SWANA WASTECON Conference, Washington, D.C., August 2012.

Sullivan, Patrick S., The Effects of New Air Modeling Standards on Landfill Gas Projects, SWANA E-Session, May 2012.

Sullivan, Patrick S., Clean Air Act Update, Conference Proceedings, Waste Expo, Las Vegas, Nevada, April 2012.

Sullivan, Patrick S., The Impact of the GHG Tailoring Rule on Title V and PSD Permitting for Landfills, Regulation Week e-Seminar, April 2012.

Sullivan, Patrick S., The Effects of New Air Modeling Standards on Landfill Gas Projects, Presentation for 35th Annual SWANA Landfill Gas Symposium, Orlando, Florida, March 2012.

Sullivan, Patrick S., Impacts from Organic Waste Management, AWMA Mother Lode Chapter Meeting, Sacramento, California, September 2011.

Sullivan, Patrick S., Air Modeling for LFG Projects, Presentation for SWANA WASTECON Conference, Nashville, Tennessee, August 2011.

Sullivan, Patrick S., Comparison of Air Quality and GHG Impacts from Organic Waste Disposal, Presentation for AWMA Golden West Chapter Annual Technical Conference, Bakersfield, California, May 2011.

Sullivan, Patrick S., When Can Co-Located Facilities be Considered Separate Sources for Air Compliance Purposes the Concept of Common Control, Presentation for 34th Annual SWANA Landfill Gas Symposium, Dallas, Texas, March 2011.

Van Kolken Banister, Amy, and Sullivan, Patrick S., LFG Collection Efficiency: Debunking the Rhetoric, MSW Magazine, Elements 2011 Issue, September 2010.

Sullivan, Patrick S., The Importance of Landfill Gas Capture and Utilization in the U.S., Columbia University, Earth and Engineering Center, Council for the Sustainable Use of Resources (SUR), April 2010.

Sullivan, Patrick S., Comparison of Landfilling and Organic Waste Diversion in Terms of Air Quality and GHG Impacts, Presentation at the 39th Annual SWANA Western Regional Symposium, San Luis Obispo, California, April 2010.

Sullivan, et al., The Impact of Federal Climate Change Legislation and Regulation on The Solid Waste Industry, Conference Proceedings, 33rd Annual SWANA Landfill Gas Symposium, San Diego, California, March 2010.

Sullivan, Patrick S., AB 32/Scoping Plan Impact on Solid Waste Industries and Local Governments, Presentation at the Southern California Waste Management Forum Annual Conference, Ontario, California, November 2009.

Sullivan, Patrick S., Global Setting: Waste Management's Response to Climate Change, Presentation for SWANA WASTECON Conference, Long Beach, California, September 2009.

Sullivan, Patrick S., CARB's New Early Action Rule for Landfills: Beyond NSPS and into the Climate Change World, Presentation for SWANA WASTECON Conference, Long Beach, California, September 2009.

Sullivan, Patrick S., Operational and Financial Impacts of CARB's New Early Action Rule for Landfills, Presentation at the 38th Annual SWANA, Western Regional Symposium, Palm Springs, California, April 2009.

Sullivan, et al., New LFG Monitoring Requirements in California: More Stringent and Expensive, Conference Proceedings, 32nd Annual SWANA Landfill Gas Symposium, Atlanta, Georgia, March 2009.

Sullivan, Patrick S., Practicalities of Implementing and Permitting a Landfill Methane Project, Presentation for the California Climate Action Registry (CCAR) Climate Action Reserve Workshop on California Landfill Methane Projects, Los Angeles, California, April 2008.

Sullivan, Patrick S., Air Quality Issues Affecting Landfills in California, Presentation SWANA Gold Rush Chapter Board Meeting, Monterey, California, April 2008.

Sullivan, Patrick S., Air Quality Issues Affecting Landfills in California, Presentation at SWANA Sierra Chapter Board Meeting, Fresno, California, January 2008.

Sullivan, Patrick S., Mitigation of Unique LFG Migration Issues, Conference Proceedings, SWANA WASTECON Conference, Reno, Nevada, October 2007.

Sullivan, Patrick S., Landfill Management Practices for Reducing GHG Emissions, Presentation for the California Integrated Waste Management Board (CIWMB) Strategic Policy Development Committee Public Workshop, Sacramento, California, May 2007.

Sullivan, Patrick S., Update on Major Air Quality Regulations Affecting Landfills, Conference Proceedings, 30th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2007.

Sullivan, Patrick S., et al., Field Comparison of Landfill Gas Collection Efficiency Measurements, Conference Proceedings, 30th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2007.

Sullivan, Patrick S., CNG, LNG, and Other Fuels from LFG, Presentation at 4th Annual Forum CA Biomass Collaborative, Sacramento, California, March 2007.

Sullivan, Patrick S., et al., Fugitive Dust Modeling with AERMOD for PM10 Emissions from a Municipal Solid Waste Landfill, Proceeding of Guidelines on Air Quality Models; an AWMA Specialty Conference, Denver, Colorado, September 2006.

Sullivan, Patrick S., Current Status of Air Quality Regulations in the Solid Waste Industry, SWANA Arizona Landfill Seminar, Phoenix, Arizona, May 2006.

Leonard, Michael L., Huff, Raymond H., and Sullivan, Patrick S., Unique Solutions to Complex LFG Migration Problems, Conference Proceedings, 29th Annual SWANA Landfill Gas Symposium, St. Petersburg, Florida, March 2006.

Sullivan, Patrick S., LFG Issues During Post-Closure Development of Landfills, Presentation at the California Integrated Waste Management Board's Post-Closure Land Use Symposium, Stockton and Ontario, California, February 2006.

Sullivan, Patrick S., Comparison of Air, Health, and Odor Impacts from Landfills vs. Composting, Presentation at the Annual SWANA WASTECON Conference, St. Louis, Missouri, September 2005.

Sullivan, Patrick S., LFG and Development on and Adjacent to Landfills in California, Presentation at the 34th Annual SWANA Western Regional Symposium, San Luis Obispo, California, May 2005.

Sullivan, Patrick S., Where Should I Put My Organic Waste: Bioreactor Landfill or Composting Facility, Conference Proceedings, NSWMA/EIA Waste Expo, Las Vegas, Nevada, May 2005.

Sullivan, Patrick S., The Role of LFGTE in California's RPS and the California Biomass Collaborative, Presentation at the 8th Annual U.S. EPA LMOP Conference and Project Expo, Baltimore, Maryland, January 2005.

Sullivan, Patrick S., Air Quality and Odor Impacts from Landfill-Related Emissions, Presentation at the 33rd Annual SWANA Western Regional Symposium, San Luis Obispo, California, May 2004.

Huff, Raymond H., and Sullivan, Patrick S., Air Quality and Odor Impacts from Landfill-Related Emissions, Conference Proceedings, Water Environment (WEF) and AWMA Odor and Air Emissions 2004, Bellevue, Washington, April 2004.

Clarke, Steve, and Sullivan, Patrick S., Estimating the Trend in NMOC Generation and Emissions after Closure of MSW Landfills, Conference Proceedings, 27th Annual SWANA Landfill Gas Symposium, San Antonio, Texas, March 2004.

Huff, Raymond H., and Sullivan, Patrick S., Unique Landfill Gas Issues on Urban Inactive Landfills, Conference Proceedings, 27th Annual SWANA Landfill Gas Symposium, San Antonio, Texas, March 2004.

Sullivan, Patrick S., et al., Landfill Gas Module, Performance-Based System for Post-Closure Care at MSW Landfill, Conference Proceedings, Conference Proceedings, 26th Annual SWANA Landfill Gas Symposium in Tampa, Florida, March 2003.

Morris, Jeremy, Sullivan, Patrick S., et al., Performance-Based System for Post-Closure Care at MSW Landfill—A New Approach to the Current 30-Year Time-Based System of Subtitle D, Conference Proceedings, NSWMA Waste Tech 2003 Conference, New Orleans, Louisiana, February 2003.

Sullivan, Patrick S., and Bins, John, Toxic Emissions from Landfills: History and Current Developments, Conference Proceedings, NSWMA Waste Tech 2003 Conference, New Orleans, Louisiana, February 2003.

Sullivan, Patrick S., and Bins, John, Measurement of Toxic Emissions from Landfills: History and Current Developments, Conference Proceedings, Symposium on Air Quality Measurement Methods and Technology—2002, AWMA, San Francisco, California, November 2002.

Walsh, James, and Sullivan, Patrick S., NSPS and Other Clean Air Act Issues—Recent Development and Workarounds, Proceedings of the SWANA WASTECON Conference, Long Beach, California, October 2002.

Sullivan, Patrick S., Update on Air Quality Permitting and Compliance Issues for MSW Landfills, Presentation at the 31st Annual SWANA Western Regional Symposium, South Lake Tahoe, Nevada, May 2002.

Sullivan, Patrick S., Huff, Raymond, and Tinker, Amy, Human Health Risk Assessment Issues for Landfills, Conference Proceedings, 25th Annual SWANA Landfill Gas Symposium in Monterrey, California, March 2002.

Sullivan, Patrick S., and Caponi, Frank R., Air Quality Compliance for Landfill Gas to Energy Projects, Conference Proceedings, 25th Annual SWANA, 25th Annual Landfill Gas Symposium, Monterey, California, March 2002.

Sullivan, Patrick S., Enhancing Energy Recovery from Landfills Using the Bioreactor Technology, Presentation at the 5th Annual U.S. EPA LMOP Conference and Project Expo, Washington, D.C., December 2001.

Pierce, Jeffrey L., and Sullivan, Patrick S., Economic and Financial Aspects of LFGTE Project Development in California, California Energy Commission/U.S. EPA Landfill Methane Outreach Program (LMOP), California Landfill Gas to Energy Workshop, California Landfill Gas Primer, Sacramento, California, October 2001.

Sullivan, Patrick S., and Green, Roger, Air Emissions, Methane Generation and Recovery, and Energy Potential for Bioreactor Landfills: Comparing the Theoretical to the Actual, Proceedings of the Annual SWANA WASTECON Conference, Baltimore, Maryland, October 2001.

Sullivan, Patrick S., Landfill Gas Modeling and Emission Estimates for a Large Bioreactor Landfill in California, Presentation at the 10th Annual SWANA Landfill Symposium, San Diego, California, June 2001.

Sullivan, Patrick S., and Caponi, Frank R., The Potential Impacts of the MACT Standard and Urban Air Toxics Strategy on MSW Landfills, Conference Proceedings, 24th Annual SWANA 24th Annual Landfill Gas Symposium in Dallas, Texas, March 2001.

Green, Roger B., Vogt, W. Gregory, and Sullivan, Patrick S., Comparison of Emissions from Bioreactor and Conventional Landfills, Conference Proceedings, Annual SWANA WASTECON Conference, Cincinnati, Ohio, October 2000.

Sullivan, Patrick S., Risk Characterization in Site Characterization and Remediation Design, Conference Proceedings, Convergence 2000 Environmental Engineering and Pipeline Engineering Conference, American Society of Civil Engineers (ASCE), Kansas City, Missouri, July 2000.

Mezzacappa, David, and Sullivan, Patrick S., Air Quality Pre-Construction Permits for Municipal Solid Waste Landfills, Conference Proceedings, 9th Annual SWANA Landfill Symposium in Austin, Texas, June 2000.

Sullivan, Patrick S., U.S. EPA's Urban Air Toxics Strategy, Conference Proceedings, Conference Proceedings, 10th Annual Technical Conference, Air and Waste Management Association (AWMA) Golden Empire Chapter, Golden West Section, Bakersfield, California, March 2000.

Sullivan, Patrick S., and Michels, Mike, The Time Is Now for Changes to the AP-42 Section on Landfills, Conference Proceedings, 23rd Annual SWANA Landfill Gas Symposium in La Jolla, California, March 2000.

Michels, Mike, and Sullivan, Patrick S., Actual LFG Emissions Lower than EPA Estimates, Conference Proceedings, National Solid Waste Management Association (NSWMA)/ Environmental Industries Association (EIA) Waste Tech 2000 Conference, Orlando, Florida, March 2000.

Sullivan, Patrick S. (lead author: Risk Assessment section), Environmental Site Characterization and Remediation Design Guidance, American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 99, ASCE, Reston, Virginia, 1999.

Sullivan, Patrick S., The Use of Methane Gas from Landfills as an Alternative Fuel Source, Presentation at the U.S. Conference of Mayors/Municipal Solid Waste Management Association Fall Summit, San Jose, California, November 1999.

Sullivan, Patrick S., A Practical Approach to Clean Air Act Compliance for Landfills, Presentation at the Annual WASTECON Conference, Reno, Nevada, October 1999.

Pierce, Jeffrey L., and Sullivan, Patrick S., NSPS, NESHAPs, NSR, and Title V: The Impact of Federal Air Quality Regulations on Landfill Construction and Operation, Conference Proceedings, 28th Annual SWANA Western Regional Symposium, South Lake Tahoe, Nevada, April 1999.

Kubis, Elizabeth L., Rankin, Sue, and Sullivan, Patrick S., Strategic Planning for Landfill Gas and Air Quality Compliance at Municipal Solid Waste Landfills, Conference Proceedings, 28th Annual SWANA Western Regional Symposium, South Lake Tahoe, Nevada, April 1999.

Albert, Lon, Kubis, Elizabeth L., and Sullivan, Patrick S., Ongoing Challenges of Emission Inventories at Municipal Solid Waste Landfills, Conference Proceedings, Emission Inventory Conference, Air and Waste Management Association (AWMA), Raleigh-Durham, North Carolina, October 1997.

Sullivan, Patrick S., Nuno, Julio A., and Lister, Kenneth H., The Use of Risk-Based Corrective Action in Site Mitigation Projects, Conference Proceedings, Environmental Engineering Conference, Canadian Society of Civil Engineers/American Society of Civil Engineers (CSCE/ASCE), Edmonton, Alberta, July 1997.

Sullivan, Patrick S., and Lister, Kenneth H., Use of Screening Level Risk Assessment for Risk-Based Corrective Action, Conference Proceedings, Association for the Environmental Health of Soils, 7th Annual West Coast Conference on Contaminated Soil and Groundwater, Oxnard, California, February 1997.

Sullivan, Patrick S., and Zbozinek, Jasenka V., Exposure Assessment and Toxic Distribution Modeling In Toxic Tort Litigation: Air and Soil Pathways, Seminar Proceedings, Phoenix Chapter of the State of Arizona Bar Association, One-Day Technical Meeting, November 1996.

SRIVIDHYA VISWANATHAN, PE

Education

MS – Civil Engineering, University of Oklahoma, 2005
BE – Civil Engineering, Delhi College of Engineering, New Delhi, India, 2002

Professional Licenses/Certifications

Registered Professional Civil Engineer
California (No. 80360)
Arizona (No. 59485)
Nevada (No. 028004)
Oklahoma (No. 24265)
Occupational Safety and Health Administration (OSHA) 40-Hour Health and Safety Training

Professional Affiliations

Solid Waste Association of North America (SWANA)
National Waste & Recycling Association (NWRA)
Society of Women Engineers (SWE)

Professional Awards

40 Under 40, Waste360, 2019
Top 50 Influential Women in Engineering Award, San Diego Business Journal (SDBJ), 2022

Professional Experience

Vidhya Viswanathan, PE, is a registered civil engineer with 17 years of experience, specializing in solid waste management services for both public and private entities. She is the Director of Engineering Services for SCS Engineers' Southwestern Business Unit, and leads the firm's solid waste engineering operations in California, Arizona, Nevada, Utah, and New Mexico. Her expertise in solid waste management and environmental engineering encompasses feasibility studies, permitting, design, construction management, operations and maintenance engineering and resolving environmental challenges related to landfill, landfill gas (LFG) and composting projects. She is experienced in the regulatory processes related to solid waste management, lending her technical expertise to support multifaceted, integrated solid waste management programs which include renewable energy and sustainable materials management.

Ms. Viswanathan is a strong client manager with excellent design, construction quality assurance (CQA), and construction skills. She has a thorough understanding of all aspects of fill operations, construction, and OM&M, and has been an integral part of several site operations teams since joining SCS in 2012. Her work includes design and installation of LFG collection systems, landfill de-watering systems, LFG Blower-Flare Station (BFS) and compost system planning, design, and construction oversight for such projects. She also prepared regulatory documents including but not limited to Joint Technical Document (JTD), remaining life assessment and financial assurance.

Ms. Viswanathan's solid waste experience has involved design of composting facilities, to help public and private entities achieve organic waste diversion to meet requirements of California's Senate Bill

(SB) 1383. She was the lead engineer for the composting facility design for Miramar Landfill in San Diego that was awarded best innovative project by the *Environmental Business Journal* in 2020. The facility diverts organic waste from the landfill; composts 40,000 tons into useful byproducts; provides an enhanced stormwater control system for green and food waste operations, and will eventually run on renewable energy generated from the existing landfill. SCS also works with additional clients such as Kern County, County of Orange, and Republic Services.

She is currently the Engineer of Record for LFG and compost design and/or construction projects for various Sites, including the City of San Diego, Miramar Complex, Aerated Static Pile Project. In 2019, she received Waste360's *40 Under 40* Award during Waste Expo, and the *San Diego Business Journal*'s *Top 50 Influential Women in Engineering* Award in 2022.

Project Work for Major Private Waste Companies and Public Entities over the last 5 years

200+ Landfill Gas Design, Construction Quality Assurance (CQA) Support and Regulatory Support Services

50+ Landfill Design, Construction Quality Assurance Support and/or Regulatory Support Services

30+ Hazardous Tank Assessments, Vapor Intrusion Mitigation, Organics Design, Construction Support and/or Regulatory Support Services

Landfill Gas Design, Construction and CQA Projects **2016 – Present**

Republic Services, Inc., GCCS Expansion Design for 2023 Apex Landfill, Las Vegas, CA. As Project Manager, Ms. Viswanathan was responsible for the design of vertical LFG extraction wells and associated header and lateral piping.

Republic Services, Inc., GCCS Expansion Design for Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the design of vertical LFG extraction wells and associated header and lateral piping.

Republic Services, Inc., GCCS Expansion CQA for Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the CQA for installation of vertical LFG extraction wells and associated header and lateral piping.

Republic Services, Inc., 2018 Blower Facility for Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan is responsible for the design of the blower facility and associated piping upgrades.

Republic Services, Inc., 2017 Air Compressor Station Design and CQA Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the design and CQA for installation of 125-hp air compressor, desiccant dryer and oil-water separator.

Republic Services, Inc., 2017 Electrical Service Upgrade Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the design and CQA for upgrading the 600 Amp electrical service to 1,600 Amp electrical service to allow operation of the air compressor station.

Republic Services, Inc., 2017 5-Year Fill and GCCS Sequence Planning Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the 5-year fill and GCCS Sequence Planning for the period 2017 to 2021.

Republic Services, Inc., 2016 De-watering System Design and CQA for Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the design and CQA of the de-watering system and associated air supply and force main piping.

Republic Services, Inc., 2016 5-Year Fill and GCCS Sequence Planning Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for the 5-year fill and GCCS Sequence Planning for the period 2016 to 2020.

Republic Services, Inc., 5-Year Permit Review/Joint Technical Update for Otay Landfill, Chula Vista, CA. As Engineer of Record, Ms. Viswanathan was responsible for updating the JTD in accordance with California Code of Regulations Title 27.

Republic Services, Inc., Regulatory Support for Otay Landfill, Chula Vista, CA. As Project Manager, Ms. Viswanathan was responsible for providing routine regulatory support for landfill and LFG issues.

Republic Services, Inc., GCCS Expansion Design for Sycamore Landfill, Santee, CA. As Project Manager, Ms. Viswanathan is responsible for the design of vertical LFG extraction wells and associated header and lateral piping.

Republic Services, Inc., GCCS Expansion CQA for Sycamore Landfill, Santee, CA. As Project Manager, Ms. Viswanathan was responsible for the CQA for installation of vertical LFG extraction wells and associated header and lateral piping.

Republic Services, Inc., 5-Year GCCS Sequence Planning Sycamore Landfill, Santee, CA. As Project Manager, Ms. Viswanathan was responsible for the 5-year GCCS Sequence Planning for the period 2017 to 2021.

Republic Services, Inc., 2016 5-Year Fill and GCCS Sequence Planning Sycamore Landfill, Santee, CA. As Project Manager, Ms. Viswanathan was responsible for the 5-year GCCS Sequence Planning for the period 2016 to 2020.

Republic Services, Inc., 5-Year Permit Review/Joint Technical Update for Borrego Landfill, Borrego Springs, CA. As Engineer of Record, Ms. Viswanathan was responsible for updating the JTD in accordance with California Code of Regulations Title 27.

Republic Services, Inc., Routine Inspection for Ramona Landfill, Ramona, CA. As Project Manager, Ms. Viswanathan was responsible for providing routine inspection, reporting, and on-call engineering services.

Republic Services, Inc., Routine Inspection for Imperial Landfill, Imperial, CA. As Project Manager, Ms. Viswanathan was responsible for providing routine inspection, reporting, and on-call engineering services.

County of San Diego, Enclosed Flare and Blower System Replacement for Jamacha Landfill, San Diego, CA (Ongoing). As Project Manager, Ms. Viswanathan is responsible for design and installation of a replacement enclosed flare and blower system at Jamacha Landfill.

County of San Diego, Enclosed Flare and Blower System Replacement for Bell Jr. High School Landfill, San Diego, CA. As Project Manager, Ms. Viswanathan was responsible for design and installation of a replacement enclosed flare and blower system at Bell Jr. High School Landfill.

County of San Diego, Enclosed Flare and Blower System Replacement for Hillsborough Landfill, San Diego, CA. As Project Manager, Ms. Viswanathan was responsible for design and installation of a replacement enclosed flare and blower system at Hillsborough Landfill.

County of San Diego, Routine Inspection for Various Landfills, CA. As Project Manager, Ms. Viswanathan was responsible for providing routine inspection, reporting, and on-call engineering services. Projects included design and oversight of the installation of LFG extraction wells, evaluation of LFG impacts on groundwater, environmental impacts of a possible air crash at an airport constructed on a landfill, permitting assistance for the addition of a flare condensate injection system, and general technical support.

City of San Diego, Feasibility Study for a New BFS, Civil Design, and Permitting for a BFS at Miramar Landfill, San Diego, CA. As Project Manager, Ms. Viswanathan was responsible for preparation of a feasibility study investigating the potential design, permitting, and economic considerations for possible locations of the new BFS, and design plans for the construction of the new BFS.

Landfill Projects

County of San Bernardino, Excavation Management Plan (EMP) for Mid-Valley Sanitary Landfill, Rialto, CA. As Project Manager, Ms. Viswanathan was responsible for the preparation of an EMP for air monitoring, mitigation, and excavation management during construction activities associated with the waste excavation and partial closure of the Unit 1 fill area and construction in the Unit 3 fill area.

Western Mesquite Mine Inert Material Landfill, Closure/Post-Closure Maintenance Plan, Brawley, CA (on-going). Ms. Viswanathan is responsible for the preparation of the closure-post closure maintenance plan for the Site, and coordinating with the permitting agency.

Blue Diamond Growers Site, Final Cover Installation, Engineer of Record. Ms. Viswanathan was responsible for the several inspections of the site, prior to, during, and post construction for the installation of the alternate final cover.

Dellar Landfill, 5-Year Settlement Analysis – Iso-Settlement Map 2017-2022, Sacramento, CA. As the Engineer of Record, Ms. Viswanathan was responsible for the five-year Iso-settlement analysis.

28th Street Landfill, 5-Year Settlement Analysis – Iso-Settlement Map 2017-2022, Sacramento, CA. As the Engineer of Record, Ms. Viswanathan was responsible for the five-year Iso-settlement analysis.

Central Park Sports Complex, Former City of Huntington Beach Landfill – 5-Year Settlement Analysis, Huntington Beach, CA. As the Engineer of Record, Ms. Viswanathan was responsible for the five-year Iso-settlement analysis.

Pima-Maricopa Indian Community, Engineering, Inspection, and Reporting Services for Salt River Landfill, Scottsdale, AZ. As Project Manager, Ms. Viswanathan was responsible for providing engineering, inspection, and reporting services for bioreactor operations to the EPA. She was also

responsible for the estimation of airspace consumed and the remaining site life, and preparation of closure/post-closure care costs.

Santa Cruz County, Engineering Services for Rio Rico Landfill, Rio Rico, AZ. As Project Manager, Ms. Viswanathan was responsible for providing engineering services for the estimation of airspace consumed and the remaining site life, and preparation of closure/post-closure care costs.

Santa Cruz County, Engineering Services for Rio Rico Landfill, Rio Rico, AZ. As Project Manager, Ms. Viswanathan was responsible for providing engineering services for the estimation of airspace consumed and the remaining site life, and preparation of closure/post-closure care costs.

Town of Huachuca City, Closure and Post-Closure for Huachuca City Landfill, Huachuca City, AZ. As Project Manager, Ms. Viswanathan was responsible for preparation of closure and post-closure care costs for financial assurance.

Articles/Publications/Presentations

Compost 2023, January 2023 – '*Lessons Learned – 1383 Compliance'* (presented by Srividhya Viswanathan, PE, and Michelle Leonard).

SWANA Western Regional Symposium, April 2022 – '*Lessons Learned for Siting Composting Facilities on a Landfill, Miramar Landfill, San Diego CA, Otay Landfill, Chula Vista CA'* (presented by Scott Woods, Sustainable Generation).

Compost 2022, January 2022 – *'Evaluating Opportunities – Composting Programs – Feasibility Evaluation and Design Considerations',* (presented by Tracie Bills, SCS Engineers)

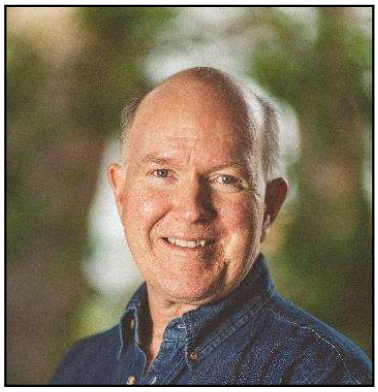
Southern California SWANA Founding Chapter Workshop, June 2019 – '*Developing Composting Sites on Landfills*'

SWANA Western Regional Symposium, April 2019 – '*Let's Cover it! – Organics Management Cutting Edge Technology*'

SWANA Western Regional Symposium, May 2018 – '*Post Closure LFG Care, Try a Micro Flare!*'

Landfill Gas Collection and Control System, 2017/2018 - 3 Part series, MSW Management

RESUME NEAL BOLTON, P.E.



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EDUCATION:

Attended Sacramento State University
Construction Engineering
Attended Montana State University
Construction Engineering

REGISTRATION:

Registered Civil Engineer — California (C48062)
Licensed General Engineering Class A Contractor — California (482821)
Licensed Timber Operator – California (B012349)
SWANA Faculty for 25+ years
Commercial Driver's License

Mr. Bolton is considered one of the foremost solid waste operations experts in the world. He has over 45 years of experience in heavy construction, landfill, transfer station, organics processing, and recycling center operations and safety. He literally wrote the books on effective landfill operations (The Handbook of Landfill Operations[1]; The Handbook of Landfill Safety[2]) and has authored hundreds of other solid waste articles on topics ranging from operations, safety, efficiency, regulatory compliance, equipment utilization, odor control, and more. Based on his broad level of experience, knowledge and reputation, Mr. Bolton has been retained more than 70 times as an expert witness on cases involving solid waste operations, compliance, and safety.

WORK EXPERIENCE:

Mr. Bolton's work experience covers the broad spectrum from equipment operator to engineer and from waste facility manager & director to expert witness.

General:
Mr. Bolton is a registered civil engineer with over 45 years of experience in heavy construction and landfill operations. His background in heavy construction includes work in excavating, grading, paving, and underground projects where he worked as a laborer, equipment operator, foreman, superintendent, and estimator. In 1988, Mr.

[1] https://blueridgeservices.com/services/operations-reviewassessment/handbook-of-landfill-operations-2/
[2] https://blueridgeservices.com/handbook-of-landfill-safety/

Bolton formed his own consulting company, Blue Ridge Services. As principal of Blue Ridge Services, he has, over the past 35^{+} years, provided operational consulting services for a wide range of private and municipal landfills and transfer stations. In his career, Mr. Bolton has worked with nearly 1,000 solid waste facilities and organizations, including more than 500 landfills.

Landfill Development:
Mr. Bolton has worked on landfill site selection, expansion, and closure projects. He has prepared hundreds of landfill development plans that included: site layout, access roads, base grade, and final grade design. He has worked on hundreds of projects involving airspace enhancement or maximization. In the late 1980s and early 1990s Mr. Bolton was very active in the implementation of the EPA's subtitle D rules.

Landfill & Transfer Station Training Programs:
Mr. Bolton has presented training programs for thousands of people through the several hundred training programs he has taught. He has provided training for numerous State and local agencies and private companies in nearly 40 States, Europe, and Australia. He has also been an instructor on the faculty of the Solid Waste Association of North America (i.e., SWANA) for more than 25 years. Mr. Bolton has overseen the development and production of approximately 250 individual safety & operational training videos for solid waste facilities. In fact, his company has produced the most comprehensive library of solid waste operational/safety videos in the world.

Landfill Plans:
Mr. Bolton has worked on hundreds of landfill plans and/or excavation plans for landfills. These sequence plans have ranged from simple seasonal plans showing how a landfill will prepare for the wet season, to long-term sequence plans taking the site from start-up through closure. Most sequence plans are based on a combination of economics, aesthetics, and practical judgment regarding access, drainage, leachate control, and minimized soil handling.

Expert Witness:
Based on his experience, knowledge and reputation, Mr. Bolton has been hired more than 70 times as an expert witness on cases involving solid waste operations, equipment design, and safe practices for landfills, transfer stations, collections, and other types of waste operations. He has testified at both civil trials and criminal trials.

Research and Development:
Mr. Bolton has designed and implemented various testing procedures for evaluating landfill equipment and operating methods including cover soil use minimization studies, compaction tests, air flow studies related to litter and odor movement using computerized fluid dynamics software and a wind tunnel. Finally, he has worked on numerous productivity analyses for many kinds of solid waste operations. Many of these

were done in cooperation with Caterpillar, Ingersoll-Rand / Aljon, Caron Compactor, Waste Management Inc., Waste Connections, Republic Services, Martin Compactor, Tana Compactor Company, and many other organizations.

Operational Planning:
Mr. Bolton has provided operational planning for scores of landfills, transfer stations and other solid waste systems in more than 40 states. These projects include preparation of operating procedures for excavation, refuse placement, load checking, surveying, waste compaction, and other day-to-day landfill tasks. He has also performed compaction/density tests, operational/safety audits, and efficiency studies. Mr. Bolton has worked on numerous projects related to placement and benefits of daily cover soil, various types of Alternative Daily Cover (ADC), and the benefits in terms of reducing infiltration, litter, odors, vectors, birds, fires, and other environmental impacts.

Landfill Equipment Evaluation:
Mr. Bolton has worked with numerous landfills, providing recommendations on equipment selection and utilization. He has developed and performing various equipment productivity analyses for dozers, scrapers, compactors, and other landfill equipment.

Solid Waste Facility Odor Mitigation
Mr. Bolton has worked on numerous odor mitigation projects in several states for landfills, organics processing sites, and other solid waste facilities. These projects have required the assessment and mitigation of various odor sources, including Landfill Active Face, Landfill Gas Emissions, Leachate Pond Odors, Odors from Excavation of Old Waste, Anaerobic Compost Operations, Compost Operations – Feedstock, Compost Operations – Grinding, Compost Operations – Windrow Turning, Odorous Load Management (i.e., sludge, dead animals, etc.), and other sources. Many of these projects required initial data collection, correlation of origin and complaint, operational mitigation. He has provided testimony for various odor-related projects.

EMPLOYMENT HISTORY:

1988 - Present
Principal - Blue Ridge Services (Atascadero, CA ...formerly Bozeman, MT)
As principal of Blue Ridge Services, a landfill consulting company, Mr. Bolton has personally supervised hundreds of solid waste projects. With a focus on landfill operations, Blue Ridge projects include development of landfill operational/safety training programs, fill sequence planning, site budgeting, equipment selection, operations planning, operational audits, compaction/density studies and a wide range of landfill site selection, upgrade, landfill expansion and closure projects.

1987-1988
Field Engineer - Waste Management, Inc. (San Jose, CA)

As a field engineer for Waste Management, Inc., Mr. Bolton was involved in the performance of landfill sequence plans, construction planning, operational audits, compaction/density testing, operator training and budgeting projects. Additionally, he prepared cost estimates for use in competitive bidding for landfill operations.

1983-1987
Field Engineer - Oakland Scavenger Company (Oakland, CA)
As the field engineer for Oakland Scavenger Company/Waste Management from 1983 to 1987 he managed landfill development and construction projects for several sites ranging in size from 200 to 7,000 tons per day.

During his employment with Oakland Scavenger/Waste Management, Mr. Bolton supervised the in-house preparation of operations plans for all of Oakland Scavenger Company's landfills. Additionally, he played a key role in the training of landfill equipment operators to perform all on-site landfill construction projects - virtually eliminating the need to subcontract out heavy construction projects. These projects included liner, leachate collection systems and final cover construction, installation of methane venting systems, road, pond, and ditch construction. These projects were performed in addition to the day-to-day excavation and landfill operations.

1978-1983
Laborer, Operator, Foreman –
Bolton Construction (Woodland, CA)
Bolton Construction was a grading and paving company. During the 5 years he was there, Mr. Bolton worked as a laborer, operator, estimator, and foreman. His duties included positions on a grading, paving and underground crew. Additionally, he supervised numerous construction projects, did bidding & estimating, and drove dump trucks and various types of heavy equipment. His equipment operating experience includes operating dozers, backhoes, rollers, compactors, motor graders, loaders, water trucks, scrapers, and trenching machines.

WRITING & CONFERENCE PRESENTATIONS:

The Handbook of Landfill Operations, a 500+page text, published by Blue Ridge Services, 1995. Mr. Bolton's book is used by landfills throughout the world. In addition to being used as a college textbook in the U.S. and Canada, it was used as a textbook by the Solid Waste Association of North America (SWANA) and for many years as the textbook for certification in the State of Virginia.

The Handbook of Landfill Safety, a 350+page text, published by Blue Ridge Services, 2009. This is the waste industry's most comprehensive book on landfill safety. It is considered a vital reference on landfill safety.

Process Improvement for Waste Facilities, a 100-page text, published by Blue Ridge Services, 2016. This book is used by solid waste professionals across North America to understand how to apply the concept of Process Improvement to solid waste operations, including collections, MRFs, transfer stations, and landfills.

Under Mr. Bolton's guidance, his company has produced: 250+ safety videos for the waste industry. Many translated to Spanish and Greek.

Mr. Bolton is the author: 250+ landfill articles and technical papers, presented in U.S., Canada, Australia, and Europe.

Mr. Boltoin has been the instructor for several hundred training classes (including 50+ for SWANA, 20+ for CalRecycle, etc.) across the U.S., Canada, and abroad. He has prepared training materials and has conducted training for the State of California, the State of Indiana, State of North Carolina, State of Montana, State of Kansas, etc.

Mr. Bolton has produced and presented: 100+ webinars for landfills, transfer stations, green waste processing facilities, collections operations, and recycling facilities for municipal and private organizations.

THE SCIENCE OF READY℠

PABLO SANCHEZ-SORIA, PhD, CIH

Senior Toxicologist II
psoria@cteh.com

INTRODUCTION

Dr. Pablo Sanchez Soria is a senior toxicologist and a certified industrial hygienist (CIH) with experience in human and environmental toxicology, risk assessment, and emergency response toxicology. Dr. Sanchez Soria obtained a B.S. with a double major in microbiology and nutritional sciences. Dr. Sanchez Soria has experience in the field of virology, researching viral fitness mechanisms, and viral adaptation to anti-viral treatments. Following his research interests, Dr. Sanchez Soria pursued a Ph.D. in Pharmacology and Toxicology at the University of Arizona, where his dissertation work characterized cardiovascular and metabolic pathophysiology in mice exposed to environmental arsenic chronically, as well as in-utero.

As a senior toxicologist at CTEH, Dr. Sanchez Soria specializes in toxicology, risk assessment, toxicity evaluations, and complex industrial hygiene challenges. He is a responding toxicologist in the CTEH Toxicology Emergency Response Program (TERP®) and regularly serves as a technical director, manages, and conducts air monitoring activities during chemical spills. He is a member of the Emergency Response Industrial Hygiene Strike Team, and a bilingual member of the CTEH International Strike Team, and has responded to several incidents in North and Central America. Dr. Sanchez Soria also manages and directs work evaluating the relationship between chemical exposure and disease, formulation of emergency response guides, and involvement in the environmental contamination and toxic tort litigation.

EDUCATION

Ph.D., Pharmacology and Toxicology | 2008 - 2013
B.S., Microbiology/Nutritional Sciences | 2006 - 2008
University of Arizona
Tucson, AZ

Science Associate | 2003 - 2005
Pima Community College
Tucson, AZ

PROFESSIONAL AFFILIATIONS

- Member, American Board of Industrial Hygiene (ABIH)
- Member, Society of Toxicology

REGISTRATIONS & CERTIFICATIONS

- 40-Hour HAZWOPER Training
- 8-Hour HAZWOPER Supervisor
- 8-Hour HAZWOPER Hands-on Training
- SCBA Respiratory Protection Training
- HIPAA certification (Health Insurance Portability & Accountability Act)
- Federal Emergency Management System - ICS100
- Federal Emergency Management System - ICS200
- Federal Emergency Management System - IS700.a
- Federal Emergency Management System - IS800.c
- Federal Emergency Management System - ICS300
- Federal Emergency Management System - ICS400
- Safeland/Safegulf training
- CPR and First Aid certified
- Certified Industrial Hygienist (11358 CP)

EMPLOYMENT

Senior Toxicologist II | 2021-Present
Project Toxicologist | 2017- 2021
Toxicologist | 2013- 2017
CTEH®, LLC, North Little Rock, AR

Graduate Research Associate, Cardiovascular Research Associate | 2008 - 2013
University of Arizona, Tucson, AZ

Undergraduate Research Assistant, Plant Sciences | 2007 - 2008
University of Arizona, Tucson, AZ

Undergraduate Research Assistant, Virology | 2006 - 2008
University of Arizona, Tucson, AZ

PABLO SANCHEZ-SORIA, PhD, CIH
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CTEH®

EXPERIENCE

Toxicology Emergency Response

- Acrylates
- Aldehydes
- Ammonia
- Argon gas
- Carbon dioxide
- Carbon monoxide
- Catalyst dust
- Chlorine
- Combustion byproducts
- Fertilizers
- Fly ash
- Petroleum Hydrocarbons (gasoline, benzene, pyrolysis gas, diesel fuel, crude oil, naphtha)
- Hydrogen bromide
- Hydrogen chloride
- Hydrogen fluoride
- Hydrogen sulfide
- Mercury
- Natural gas, LPG, Butane, Propane, Propylene
- Particulate matter
- Pesticides
- Styrene

Litigation Support

Product Liability Involving:

- 1, 3-Dimethylamylamine
- Borates
- Gypsum
- Synthetic Vitreous Fibers

Toxic Tort Involving:

- Air pollution
- Arsenic
- Asbestos
- Benzene
- Chlorine
- Crystalline silica
- Diesel exhaust
- Dioxins and furans
- Ethanol
- Ground/Groundwater salinity
- Metals
- Naturally Occurring Radioactive Material (NORM)
- Particulate matter
- Pesticides
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Total Petroleum Hydrocarbons (TPHs)

Odor Nuisance Involving:

- Food and fragrance industriest
- Industrial chemicals
- Landfill facilities
- Vapor Intrusion

Risk Assessment and Risk Communication

- COVID-19 pandemic plan development, and on-the-ground support
- Crisis communication guide and response plan development
- Ebola preparedness response plan
- Indoor air quality assessments
- Occupational exposure assessments
- Worker Biomonitoring

Worker Exposure Response

- Battery acid fumes
- Chlorine
- Diesel fume/exhaust
- Diisocyanates
- Dodecene
- Electrical fire smoke
- Hydraulic fluid
- Hydrochloric acid
- Hydrogen peroxide
- Lead dust
- Mercaptans
- Perchloric acid
- Sodium hydroxide
- Sulfur
- Sulfuric acid
- Tributyl tetradecyl phosphonium chloride
- Vinyl chloride

Safety Data Sheet (SDS) and Emergency Response Planning Guidelines (ERPG)

- Butane SDS
- Carbon Disulfide ERPG
- Diesel fuel (Middle distillates) ERPG
- Nitrogen Dioxide ERPG
- Petroleum hydrocarbon SDS (various)

Scientific Journal Peer Reviewer

- Toxicological Sciences
  Toxicology and Applied Pharmacology
- Environmental Toxicology
- Journal of the International Society of Sports Nutrition
- Food and Chemical Toxicology Journal
- Internal Medicine
- Medical Sciences

PUBLICATIONS

Scientific Publications:

1. Pablo Sanchez-Soria, Derrick Broka, Stephanie Quach, Rhiannon Hardwick, Todd D. Camenisch. Fetal exposure to arsenic results in hyperglycemia, hypercholesterolemia, and

nonalcoholic fatty liver disease in adult mice. June 23, 2014. J Toxicol Health 2014; 1: 1.

2. Ingrid Druwe, James Sollome, Pablo Sanchez-Soria, Rhiannon Hardwick, Todd D. Camenisch, Richard Vaillancourt. Arsenite induces NF-κB through C-Reactive Protein. Toxicol Appl Pharmacol June 15th 2012. 261, 3, pg 263-270.

3. Pablo Sanchez-Soria, Derrick Broka, Sarah L. Monks, Todd D. Camenisch. Chronic Low-level Arsenite Exposure through Drinking Water Increases Blood Pressure and Promotes Concentric Left Ventricular Hypertrophy in Female Mice. Toxicologic Pathology, January 3rd 2012. Vol. 40, 3, pg 504-512.

4. Pablo Sanchez-Soria, Todd Camenisch. ErbB Signaling in Cardiac Development and Disease. Semin Cell Dev Biol. 2010 Dec 21st Vol 21, 9, pg 929-935.

5. James E. Cherwa, Pablo Sanchez-Soria, Holly A. Wichman, and Bentley Fane. Viral Adaptation to an Antiviral Protein Enhances Fitness Above the Uninhibited Wild-Type Level. Journal of Virology, Nov 2009. Vol 83, 22, pg 11746-11750.

Book Chapters:

1. Role of the Industrial Hygienist During a Pandemic - American Industrial Hygiene Association. Roger Lewis, Rob Strode, Lisa Brosseau, Kae Aithinne, Donald Weekes, Steven Welty, Steven Derman, Pablo Sanchez-Soria, Christopher Kuhlman, John Engel, Kee-Hean Ong.

2. Toxicology of Synthetic Vitreous Fibers - Toxicology Principles for the Industrial Hygienist, Second Edition. Pablo Sanchez-Soria, Joshua Harrill, Kenneth Still, Thomas Hesterberg. - August 2019.

3. Effective Use of Air Dispersion Modeling as a Tool for Responders During Chemical Emergencies. - Air Dispersion Modeling for Emergency Response. Scott Skelton, Pablo Sanchez Soria, Glenn Millner. - In press.

SCIENTIFIC PRESENTATIONS

1. "Chlorine Health Effects - Toxicology, Exposure and Treatment" May 2, 2022. CHLOREP Institute. Jackson, MS.

2. "Health Effects and First Aid for Mission Chemicals Exposure" May 5, 2022. CHLOREP Institute, Jackson, MS.

3. "Worker and Community Exposure Assessments During an Emergency Response" September 11, 2018. AIHA Rocky Mountain Section 2018 Meeting. Denver, CO.

4. "Value of Transparent Data Collection and Risk Communication" May 21, 2018. AIHce 2018 National Meeting. Philadelphia, PA.

5. "Toxicology of Particulate Matter - Synthetic Mineral Fibers" May 20, 2018. AIHce 2018 National Meeting. Philadelphia, PA.

6. "A Guide to Worker and Community Exposure Assessments During a HAZMAT Release" July 29, 2016. AAMSCO - Infragard Meeting. North Little Rock, AR.

7. "Worker Exposure Response Program - Benefits of Chemical Exposure Documentation in the Workplace" June 10, 2016. ASAOHN Conference, Petit Jean, AR.

8. "Role of in-utero and Chronic Arsenite Exposure in the Development of Adult Cardiovascular Pathogenesis" July 19th 2013. Final Dissertation Defense. University of Arizona, Department of Pharmacology and Toxicology.

9. "In-utero Arsenic Exposure as an Environmental Trigger of Metabolic Syndrome" April 3rd 2013. University of Arizona. Pharmacology and Toxicology departmental seminar.

10. "eNOS as a Cardiovascular Target of Arsenic Toxicity" February 29th 2012. University of Arizona. Pharmacology and Toxicology departmental seminar.

11. "Understanding Arsenic as a Cardiovascular Toxicant" September 22nd 2011. University of Arizona. Superfund Research Program seminar.

12. "Chronic Arsenite Exposure Increases Blood Pressure and Promotes Concentric Ventricular Hypertrophy" February 2nd 2011. University of Arizona, Pharmacology and Toxicology departmental seminar.

13. "Getting at the Heart of Arsenic Toxicity" December 16th 2010. University of Arizona, Superfund Research Program seminar.

14. "Low Level Arsenite Exposure and its Effects on Cardiovascular Development and Disease Onset" April 23rd 2010. University of Arizona, Cardiovascular Development Research group seminar.

15. "Low Level Arsenite Exposure and its Effects on Cardiovascular Development and Disease Onset" April 21st 2010. University of Arizona, Pharmacology and Toxicology departmental seminar.

16. "Chronic Low-Level Arsenite Exposure and its Effects on

Cardiovascular Development and Disease" March 25th 2010. University of Arizona, Superfund Research Program seminar.

SYMPOSIA

Abstracts:

1. Pablo Sanchez Soria, D. Broka, S. Quach, R. Hardwick, T.D. Camenisch. In utero arsenic exposure results in late onset hyperglycemia, dyslipidemia and Macrovesicular Steatosis in Adult Mice. Society of Toxicology Annual Meeting. March 10th – 14th 2013. San Antonio, TX.

2. Pablo Sanchez Soria, D. Broka, S. Quach, P. Parker, T.D. Camenisch. Arsenic as a cardiovascular toxicant. From physiological to biochemical characterization. Frontiers in Biomedical Research Poster Forum. November 2nd 2012. University of Arizona, Tucson, AZ.

3. Pablo Sanchez Soria, D. Broka, S. Quach, P. Parker, T.D. Camenisch. Arsenic as a cardiovascular toxicant. From physiological to biochemical characterization. Superfund Annual Meeting. October 21st – 24th 2012. Raleigh, NC.

4. Pablo Sanchez Soria, S. Quach, P. Parker, T.D. Camenisch. Arsenite exposure decreases eNOS protein levels and affects its phosphorylation profile in a model of human placental endothelial cells EA.hy 926. Society of Toxicology Annual Meeting. March 11th – 15th 2012. San Francisco, CA.

5. Pablo Sanchez Soria, T. Huang, P. Allison, S. Quach, S. Monks, D. Broka, P. Parker, T.D Camenisch. Arsenic as a cardiovascular toxicant in development and disease. Frontiers in Biomedical Research Poster Forum. October 21st 2011. University of Arizona, Tucson, AZ.

6. Pablo Sanchez Soria, D. Broka, S.L. Monks, T.D. Camenisch. Low-level arsenite exposure through drinking water increases blood pressure and promotes concentric left ventricular hypertrophy in mice. Society of Toxicology Annual Meeting. March 6th -10th 2011. Washington D.C.

7. Pablo Sanchez Soria, S. Monks, D. Broka, T.D. Camenisch. Low-level arsenite exposure through drinking water increases blood pressure and promotes concentric left ventricular hypertrophy in mice. Water Forum 2010: Our Water Future. November 22nd 2010. Tucson, AZ.

8. Pablo Sanchez Soria, S. Monks, D. Broka, T.D. Camenisch. Low-level arsenite exposure through drinking water increases blood pressure and promotes concentric left ventricular hypertrophy in mice. Superfund Annual Meeting November 10th -12th 2010. Portland, OR.

9. Pablo Sanchez Soria, D. Broka, T.D. Camenisch. Chronic low-level arsenite exposure and its effects on cardiovascular development and disease. Pharmacology and Toxicology, College of Pharmacy, University of Arizona. Mountain-West Regional Society of Toxicology Meeting. September 9th -10th 2010. Tucson, AZ.

10. Pablo Sanchez Soria, D. Broka, T.D. Camenisch. Chronic low-level arsenite exposure and its effects on cardiovascular development and disease. Pharmacology and Toxicology, College of Pharmacy, University of Arizona. Society of Toxicology Annual Meeting, March 7th -11th 2010. Salt Lake City, UT.

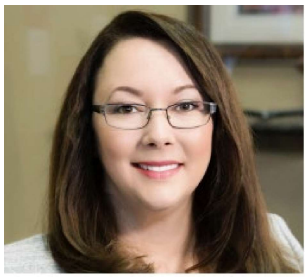
11. James Cherwa, Pablo Sanchez Soria, Bentley Fane. Scaffolding proteins in the ability to perform a conformational switch confer dominant lethal assembly defects. Department of Microbiology, University of Arizona and the BIO5 Institute. October 22nd 2007. Tucson, AZ.

12. Pablo Sanchez Soria, Jeremy Kapteyn, David R. Gang. Identification and characterization of flavonoid O-methyltransferases from sweet basil (Ocimum basilicum). Department of Plant sciences and BIO5 Institute, University of Arizona. The 19th Rocky Mountain Regional Meeting. American Chemical Society, October 15th 2006. Tucson, AZ

Angie Perez, PhD, CIH

Senior Toxicologist

aperez@cteh.com



INTRODUCTION

Dr. Angie Perez is a Senior Toxicologist for CTEH, LLC and Certified Industrial Hygienist (Cert # 12489) through the Board for Global EHS Credentialing. She has more than 20 years of experience in the field of toxicology, chemical exposure assessment, and human health risk assessment in occupational and non-occupational settings. Dr. Perez completed her PhD in Toxicology at Oregon State University where her research focused on metals and metalloids bioavailaiblity in soils and aquatic systems and human health risk assessment from consumption of crops in agricultural systems with potentially high metal or metalloid inputs.

Dr. Perez's toxicology and industrial hygiene experience includes exposure assessments using both direct measurement and historical reconstruction techniques. She has participated in numerous air monitoring and sampling campaigns to measure asbestos, volatile organic compounds, per- and polyfluoroalkyl substances, acid gases, metals, particulates, and reduced sulfur compounds. As part of Dr. Perez's risk communication experience, she has participated in multiple community meetings to share information relating to environmental investigations and risk assessment following chemical releases. Dr. Perez's toxicology experience also includes synthesis of epidemiological data via systematic review of the published literature using the GRADE and PRISMA guidelines.

Dr. Perez has more than 50 published manuscripts and abstracts involving exposure assessment and reconstruction, applied toxicology, and human health risk assessment. Her more recent focal research and field experience includes evaluation of exposures and potential health risks of air- and waterborne contaminants, biological modeling for impairment with drugs, and exposure and human health risk assessment of per- and polyfluoroalkyl substances (PFAS).

EDUCATION

Ph.D., Toxicology,
Oregon State University,
Corvallis, OR

B.A., cum laude,
Oregon State University,
Corvallis, OR

REGISTRATIONS & CERTIFICATIONS:

- Certified Industrial Hygienist (CIH) (Cert # 12489) (2021)
- 40 hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification
- AHERA Building Inspector (asbestos) (2021-current)

EMPLOYMENT

- Senior Toxicologist, CTEH, LLC., Portland, Oregon, 2017 - Present
- Managing Health Scientist, Cardno ChemRisk, Portland, Oregon, 2009 - 2017
- Postdoctoral Researcher, University of California, San Francisco, Department of Pharmaceutical Chemistry, San Francisco, CA, 2008 - 2009

MEMBERSHIPS AND AFFILIATIONS:

- Food Safety and Environmental Stewardship Board Member, Oregon State University (2018-current)
- Affiliate faculty, Oregon State University, Department of
- Environmental and Molecular Toxicology (2015-current)
- Society of Toxicology (SOT) (2003-2009, 2019-current)
- Society of Environmental Toxicology and Chemistry SETAC) (2004-2021)
- Interstate Technology & Regulatory Council (ITRC) (2019)
- American Industrial Hygiene Association (2019-current)
- American Conference of Governmental Industrial Hygienists (2020-current)
- Air & Waste Management Association (2019-current)

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SELECT PROJECT EXPERIENCE

1. Provided expert toxicology consultation and risk assessment related to potential phthalate exposures from rubber flooring material. This work involved assessment of measured data, chemical migration modeling, and assessment of health risk associated with exposures.
2. Assisted with a human health risk assessment for exposure to perfluorochemicals, including PFOA and PFOS, polybrominated diphenyl ethers (PBDEs), antimicrobials (triclosan and triclocarban), and metals and metalloids at an agricultural site that had received over two decades of land-applied biosolids. This project involved plant uptake modeling, surface to groundwater movement, and soil-toplant-to-cattle uptake with respect to human exposures.
3. Conducted a human health risk assessment in a case involving phthalate exposure in automobile interiors. This assessment involved child, adolescent and adult exposures via inhalation, dermal, and ingestion routes of exposure.
4. Conducted a screening-level human health risk assessment for arsenic at a residential site intended as a real estate or investment property in New York. This project involved review and comparison against guidance values presented in 6 NYCRR Part 375.
5. Served as consulting toxicologist to assess the potential health risk from exposure to indoor hydrocarbon vapors migrating from beneath a commercial site. The chemicals assessed included TPHg, TPHd, benzene, PCE and TCE. This project involved vapor intrusion modeling using the DTSC HERO program.
6. Served as consulting toxicologist on a human health risk assessment involving potential exposures to arsenic in soils at a commercial site. This project investigated cancer and non-cancer risks to intrusive workers.
7. Served as expert toxicologist on a human health risk assessment involving potential exposures to total petroleum hydrocarbons, benzene, toluene, ethylbenzene, total xylenes, methyl tert-butyl ether, diisopropyl ether, ethyl tert-butyl ether, tert-amyl methyl ether, tert- butyl alcohol, naphthalene, trichloroethylene and perchloroethylene. This project included risk assessment utilizing vapor intrusion modeling.
8. Conducted a risk assessment to assess compliance with Proposition 65 and the California Safe Cosmetics Act for a cosmetic fingernail product. The comprehensive risk assessment included estimates of daily exposure associated with consumer uses of the product via the inhalation, dermal, and ingestion routes of exposure. This work involved investigating different agency positions on what is considered a "trace" contaminant.
9. Human Health and Ecological Risk Assessment support for a site in Louisiana, USA. On behalf of a private client, a screening-level risk assessment was conducted to determine the hazards associated with receptors exposed to concentrations of metals, petroleum hydrocarbons, and radionuclides found in soil and groundwater on a large property. Project included review of RECAP, EPA SSL, EcoSSL guidelines, and the current peer-reviewed literature for use in the preparation of an expert report.
10. Developed a model to estimate partitioning and distribution of metals and metalloids in soils, waters, and plants. Helped develop maximum allowable concentrations of non- nutritive constituents in commercial fertilizer sold in the state of OR. Presented data and offered recommendations at biannual stakeholder meetings for the Oregon Department of Agriculture. Published human health risk assessment for the accumulation of cadmium in edible crop tissue from metal impurities in commercial fertilizers applied at agronomic rates.
11. Utilized the following statistical modeling/visualization approaches for publication: ANOVA, multiple linear regression, principal component analysis, linear, canonical, and quadratic discriminant function analysis, hierarchal tree; assisted with neural network and genetic neural network analysis.
12. Conducted a human health risk assessment for metal contamination at a former gas station site intended for commercial use.
13. Assisted with toxicology assessment and risk communication on behalf of the Washington River Protection Solutions (WRPS) as part of their work at a nuclear waste cleanup site in Washington state.
14. Prepared a human health risk assessment for child and adult receptors living in proximity to a mineral wool production facility on behalf of a confidential client.

15. Provided expert toxicology services for a client with a facility located in Europe with known groundwater contamination with PFAS. Advised on exposures and potential health risks to community populations.
16. Assisted with the preparation of an epidemiological assessment using the GRADE methodology to determine whether an association exists between PFOA and PFOS exposure and changes in serum cholesterol.
17. Prepared an assessment of all biomonitoring studies conducted in a region in Europe with known groundwater contamination with PFAS. The data were evaluated against global PFAS concentrations in serum and against toxicological benchmarks for potential effects.
18. Expert retention and consultation services regarding exposures from asbestos-containing floor tiles. Conducted a literature review and analysis of asbestos-containing floor tiles. This work involved a meta-analysis of available exposure data pertaining to floor tile- related tasks.
19. Retained as a testifying expert in a case involving exposure to gaskets in an industrial setting. This project involved calculation of an exposure estimate and assessment of human health risk associated with asbestos disease.
20. Retained as a consulting expert in case involving the potential for human health and ecological risk associated with chemicals in land-applied biosolids.
21. Served as a consulting expert in a workman's compensation case involving historical exposure to asbestos-containing materials. This project involved calculation of an exposure estimate, preparation of a report and slides.
22. Served as consulting toxicologist to assess the potential health risk from exposure to indoor hydrocarbon vapors migrating from beneath a commercial site. The chemicals assessed included TPHg, TPHd, benzene, PCE and TCE. This project involved vapor intrusion modeling using the DTSC HERO program.
23. Served as consulting toxicologist on a human health risk assessment involving potential exposures to arsenic in soils at a commercial site. This project investigated cancer and non-cancer risks to intrusive workers.
24. Served as expert toxicologist on a human health risk assessment involving potential exposures to total petroleum hydrocarbons, benzene, toluene, ethylbenzene, total xylenes, methyl tert-butyl ether, diisopropyl ether, ethyl tert-butyl ether, tert-amyl methyl ether, tert- butyl alcohol, naphthalene, trichloroethylene and perchloroethylene. This project included risk assessment utilizing vapor intrusion modeling.
25. Conducted a risk assessment to assess compliance with Proposition 65 and the California Safe Cosmetics Act for a cosmetic fingernail product. The comprehensive risk assessment included estimates of daily exposure associated with consumer uses of the product via the inhalation, dermal, and ingestion routes of exposure. This work involved investigating different agency positions on what is considered a "trace" contaminant.
26. Human Health and Ecological Risk Assessment support for a site in Louisiana, USA. On behalf of a private client, a screening-level risk assessment was conducted to determine the hazards associated with receptors exposed to concentrations of metals, petroleum hydrocarbons, and radionuclides found in soil and groundwater on a large property. Project included review of RECAP, EPA SSL, EcoSSL guidelines, and the current peer-reviewed literature for use in the preparation of an expert report.
27. Developed a model to estimate partitioning and distribution of metals and metalloids in soils, waters, and plants. Helped develop maximum allowable concentrations of non- nutritive constituents in commercial fertilizer sold in the state of OR. Presented data and offered recommendations at biannual stakeholder meetings for the Oregon Department of Agriculture. Published human health risk assessment for the accumulation of cadmium in edible crop tissue from metal impurities in commercial fertilizers applied at agronomic rates.
28. Utilized the following statistical modeling/visualization approaches for publication: ANOVA, multiple linear regression, principal component analysis, linear, canonical, and quadratic discriminant function analysis, hierarchal tree; assisted with neural network and genetic neural network analysis.
29. Conducted a human health risk assessment for metal contamination at a former gas station site intended for commercial use

30. Served as consulting toxicologist on a project involving naturally occurring asbestos (NOA) at a remote site. This work involved interpretation and communication of state and regional regulations, including those put forth by the California Air Resources Board and the South Coast Air Quality Management District, regarding NOA.
31. Conducted a screening level risk assessment for vapor intrusion at a warehouse location. The health claims were of preventricular contractions as a result of intermittent exposure in a storage room. This work involved analysis and interpretation of sampling data, literature review regarding health claims, and technical assembly of knowledge regarding the health claims.
32. Assisted with technical assembly of information regarding coal fly ash at a landfill location. This work involved literature review and synthesis, calculation of site-specific exposure values, and an assessment of human health risk.
33. Tested emissions from three dimensional (3D) printers at a research facility. The emissions involved testing of several types of 3D printers including acrylonitrile-butadienestyrene (ABS), fused deposition modeling (FDM), and stereolithography apparatus (SLA) for particulates, metals, volatile organic compounds (VOCs), and other gases, such as carbon monoxide and hydrogen cyanide.
34. Tested commercial costume cosmetics sold in California for over 50 elements including arsenic, lead, mercury, nickel, chromium, cadmium, and antimony. These data were used to conduct a human health risk assessment via dermal and ingestion routes of exposure.
35. Performed field sampling of soils at an agricultural site that had received over two decades of land-applied biosolids. Soils were tested for perfluorochemicals including PFOA and PFOS, polybrominated diphenyl ethers (PBDEs), antimicrobials (triclosan, triclocarban), and metals. This project involved a screening-level human health risk assessment through various exposure pathways.
36. Conducted sampling and analysis of high molecular weight chemicals used in automotive interiors. This work involved a comprehensive human health risk assessment.
37. Conducted a simulation study investigating the potential exposures of workers handling asbestos-containing materials; tasks included preparation of materials, instrument calibration, coordination of sample analysis, data entry and analysis.
38. Developed a database of literature regarding pharmaceuticals and personal care products (PPCPs) in aquatic systems globally. Developed a scoring system and framework to identify the most important nonregulated PPCP chemicals in reference to human health and impending restrictions. Extracted reported water concentrations for these priority PPCP chemicals from the primary and gray literature, governmental reports, and unpublished sources.
39. Performed elemental and stable isotope profiling and fingerprinting analysis to determine country of origin of food commodities. Geographic authenticity fingerprinting was coupled with neural and genetic neural networking statistical analyses to provide estimates of robustness of reproducibility of the fingerprinting model.
40. Project research lead to elucidate specific mechanisms of toxicity from intracellular Hg binding. Developed methods in the creation of Hg adducts on proteins and peptides, synthesized and purified peptides, quantified and purified proteins, performed extensive analytical analysis of protein and peptide modifications.
41. Performed field collection and laboratory analysis of waters, plants, sediments, soils and invertebrate and vertebrate organisms for metals and organic compounds. Projects included work at the Portland Harbor Superfund site, Oregon, USA, in addition to agricultural, industrial, and urban field sites.
42. Surveyed scientific literature to determine potential chemical markers and methodologies for tire wear particles found in soils
43. Quality Assurance Training and compliance, including in depth training and application of Good Laboratory Practice (GLP) guidelines such as the development and validation of field and analytical methods, draft and implementation of standard operating procedures (SOP) and standard analytical methods (SAM), bench sheets, and participation in facility audits.
44. Analytical Techniques: Instrumentation: Total Mercury Analysis, ICPAES, ICPOES, ICPMS, LCMS, GCMS, HPLC; Column chromatography: Ion exchange, Size Exclusion, Affinity – gravity columns; Peptide synthesis and purification; Spectrophotometry; Stopped Flow; Fluorescence spectroscopy.

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Senior Toxicologist
aperez@cteh.com

PUBLICATIONS

1. Perez, A., Lumpkin, M., Kornberg, T., Schmidt, A. 2023. Critical endpoints of PFOA and PFOS exposure for regulatory risk assessment in drinking water: Parameter choices impacting estimates of safe exposure levels. Reg. Toxicol Pharmacol. Feb; 138:105323.
2. Zisook, R, Simmons, B, Vater, M, Perez, A, Donovan, E, Paustenbach, D, Cyrs, W. 2020. Emissions Associated with Operations of Four Different Additive Manufacturing Technologies. J Occup Environ Hyg. Oct; 17(10):464-479.
3. Perez, A.L., Nelson, M.L Cheng, T.J., Comerford, C.E., Scott, P.K. 2018. A meta-analysis of airborne asbestos fiber concentrations from work with or around asbestos containing floor tile. Int. J. Occup. And Environ. Health. Oct 24 (3-4): 134-148.
4. Perez, A.L., Nembhard, M., Monnot, A., Bator, D., Madonick, E., Gaffney, S.H. 2017. Child and adult exposure and health risk evaluation following the use of metal- and metalloid-containing costume cosmetics sold in the United States. Reg. Toxicol Pharmacol. 84: 54-63.
5. Perez, A.L., Poteete, C., Louie, F., Garner, L., Monnot, A., Zisook, R., Scott, P.K. State of the Science and Metaanalysis of Crop Uptake of Per- and Polyfluoroalkyl Substances (PFAS). Conference short-paper. 2017. Access at: http://dioxin20xx.org/.
6. Perez, A.L., M. Nembhard, A. Monnot, D. Bator, E. Madonick, and S.H. Gaffney. 2017. Supplementary data set for child and adult exposure and health risk evaluation following the use of metal- and metalloid-containing costume cosmetics sold in the United States. Data in Brief. 13:129-131.
7. Perez, A.L., Liong, M., Plotkin, K., Rickabaugh, K.P., Paustenbach, D.J. Health risk assessment of exposures to a high molecular weight plasticizer present in automobile interiors. 2017. Chemosphere. 167:541-550.
8. Perez, A.L., A.M. Gauthier, T. Ferracini, D.M. Cowan, T. Kingsbury, and J. Panko. 2016. The challenge of predicting problematic chemicals using a decision analysis tool: Triclosan as a case study. Integr Env Assess Manag. 13(1):198-207.
9. Kopelovich, L., A.L. Perez, N. Jacobs, E. Mendelsohn, and J.J. Keenan. 2015. Screening-level human health risk assessment of toluene and dibutyl phthalate in nail lacquers. Food Chem Tox. Food Chem Tox. 81:46-53.
10. Gauthier, A.M., M. Fung, J. Panko, T. Kingsbury, A.L. Perez, K. Hitchcock, T. Ferracini, J. Sahmel, A. Banducci, M. Jacobsen, A. Abelmann, E. Shay. Chemical Assessment State of the Science: Evaluation of 32 decision-support tools used to screen and prioritize chemicals. Integr. Enviro. Assess. Manage. 11(2): 242-255.
11. Madl, A.K., K.D. Devlin, A.L. Perez, D.M. Hollins, D.M. Cowan, P.K. Scott, K. White, T.J. Cheng, and J.L. Henshaw. 2015. Airborne asbestos exposures associated with gasket and packing replacement: A simulation study of flange and valve repair work and an assessment of exposure variables. Reg Tox Pharmacol. 71(1):35-51.
12. Madl, A. K., D. M. Hollins, K. D. Devlin, E. P. Donovan, P. J. Dopart, P. K. Scott, and A. L. Perez. 2014. Airborne asbestos concentrations associated with gasket and packing replacement: a simulation study and meta-analysis. Reg Tox Pharm. 69(3):304-19.
13. Cowan, D. M., T. Kingsbury, A. Perez, T.A. Woods, M. Kovochich, D. Hill, A.K. Madl, and D.J. Paustenbach, 2014. Evaluation of the California Safer Consumer Products Regulation and the impact on consumers and product manufacturers. Reg Tox Pharm. 68, 23-40.
14. Perez, A.L., M. Anderle de Sylor, A.J. Slocombe, M.G. Lew, K.M. Unice, and E.P. Donovan. 2013. Triclosan occurrence in freshwater systems in the United States (1999-2012): A meta-analysis. Env Tox Chem. 32(7); 1479-1487.
15. Perez, A.L. and K.A. Anderson. 2009. DGT estimates Cd accumulation in wheat and potato from phosphate fertilizer applications. Sci. Total Environ. 407:5096–5103.
16. Perez, A.L. and K.A. Anderson. 2009. Soil-DGT partition coefficients estimate Cd and Ni bioavailability to crops and accumulation in soils at fertilized field sites; Environ. Toxicol. Chem. 28(10); 2030-2037.
17. Perez, A.L. 2008. Long-Term Fertilizer Input Influences Total and Bioavailable Metal in Agricultural Soils and Crops. Doctoral thesis. Corvallis: Oregon State University. 1957/9090.
18. Perez, A.L., B.W. Smith and K.A. Anderson, KA. 2006. Stable Isotope and Trace Metal Profiling Combined with Classification Models to Differentiate Geographic

Growing Region of Three Fruits: Effects of Subregion and Variety; J. Agric. Food Chem. 54(13); 4506-4516.

SELECT PRESENTATIONS:

1. DRI – Products, Nashville, TN, August 21, 2021. Invited speaker: Emerging roadside field technology for determining cannabis intoxication.
2. Schmidt, A., McAfee, M., Kind, J., Perez, A. Risk assessment of oral intake of PFAS from FDA's Total Diet Study. Society of Toxicology (SOT) 59th Annual Meeting, Anaheim, CA. March 15-19, 2020.
3. EPA START/ODEQ Presentation (invited speaker) Dec 19, 2019 (Emergency Response Collaborations in the Pacific Northwest).
4. Perrin Cannabis Seminar (invited speaker) Jun 26-27, 2019, San Francisco, CA.
5. Mahoney, S.L., Cheng, T.J., Fung, E.S., Perez, A.L. Evaluation of potential health risks associated with the ingestion of asbestos. Society of Toxicology, 2018.
6. Perez, AL. The use and abuse of science in the courtroom. Invited Panelist, American Bar Association Toxic Tort Environmental Law Division. April 5-7, 2018, Phoenix, Arizona.
7. Perez, AL, Poteete, C, Louie, F, Garner, L, Monnot, A, Zisook, R, Scott, PK. 2017. State of the science and meta-analysis of crop uptake of per- and polyfluoroalkyl substances (PFAS) (Abstract ID 10129). Presented at the DIOXIN 2017 Symposium, Vancouver Canada, August 21, 2017.
8. Monnot, A, Miller, E, Garnick, L, Beckett, E, Perez, A, Scott, PK, Zisook, R. 2017. An Evaluation of Federal and State Perfluorooctanoic acid (PFOA) Drinking Water Standards in the US (Abstract ID 10145). Presented at the DIOXIN 2017 Symposium, Vancouver Canada, August 24, 2017.
9. Scott, PK, Perez, A, Zisook, R, Monnot, A. 2017. A Probabilistic Evaluation of the 2016 U.S. EPA Health Advisory for Perfluorooctanoic Acid (Abstract ID 10146). Presented at the DIOXIN 2017 Symposium, Vancouver Canada, August 22, 2017.
10. Perez, AL, Hagstrom, E. Beyond PFOA and PFOS — the Next Wave of Perfluorochemicals-Related Liability. Webinar; June 15, 2017. Hosted by Sedgwick LLP.
11. Perez, AL, Shalhoub, M. Seeing through the haze of marijuana-related liability. Goldberg Segalla Toxic Torts and Environmental Law Seminar, May 23, 2017. New York, NY.
12. Perez, AL. Bernier, T.B. Nanotechnology's evolving benefits, risks, and liabilities. Goldberg Segalla Toxic Torts and Environmental Law Seminar, May 23, 2017. New York, NY.
13. Perez AL, Nembhard M, Monnot A, Bator D, Madonick E, Gaffney S. Child and adult exposure and health risk evaluation following the use of metal- and metalloidcontaining costume cosmetics sold in the United States. Pacific Northwest Chapter Society of Environmental Toxicology and Chemistry (SETAC). Anchorage, AK. April 21, 2017.
14. Perez, A.L. Triclosan concentration in Freshwater Systems in the United States. Invited presenter at San Francisco State University, Department of Chemistry. San Francisco, CA. March 10, 2017.
15. Perez, A.L. Human Health Assessment of Toluene and Dibutyl Phthalate in Nail Lacquers. Invited Speaker. Department of Toxic Substances Control (DTSC) Public workshop on potential health and safety impacts of chemicals in nail products. March 2, 2017, Sacramento, CA.
16. Perez. A.L. Triclosan concentrations in freshwater systems in the United States. Invited Speaker. Department of Toxic Substances Control (DTSC) Stakeholder Discussion of Aquatic Monitoring and Hazard Traits of NPEs and Triclosan. January 11, 2017. Sacramento, CA.
17. Perez, A.L., Liong, M., Plotkin, K., Rickabaugh, K.P., Paustenbach, D.J. Health risk assessment of exposures to a high molecular weight plasticizer present in automobile interiors. Society of Environmental Toxicology and Chemistry (SETAC) North America 37th Annual Meeting, World Congress, Orlando, FL November 6-10, 2016.
18. Perez, A.L. Modeled and measured triclosan concentrations in freshwater systems in the United States. Society of Environmental Toxicology and Chemistry (SETAC) North America 34th Annual Meeting, Nashville, TN. November 17-22, 2013. Invited platform presentation.
19. Kingsbury, T., Gauthier, A., Ferracini, T., Panko, J., Perez, A. 2013. Predicting chemistries targeted for deselection:

Triclosan as a case study. Poster # CS-404-20. American Industrial Hygiene Conference & Exposition. Montreal, Canada; May 18-23, 2013 – poster presentation. Winner of 'Best of Session' award for Stewardship and Sustainability.

20. Perez, A.L. After bisphenol A, brominated flame retardants… what's next? Keynote Speaker. Toy Industry Association, Safer Products Summit. April 3, 2013. Sacramento, CA.
21. Perez, A.L., M. Anderle de Sylor, A. Joseph, M.G. Lew, A.J. Slocombe, E.P. Donovan and K.M. Unice. 2011. Triclosan occurrence in freshwater systems in the United States (1999-2010): A meta-analysis. Abstract # MP146. Society of Environmental Toxicology and Chemistry (SETAC) North America 32nd Annual Meeting, Boston, MA. November 13-17, 2011. – poster presentation.
22. Cowan, D.M., M. Anderle de Sylor, L. Lievense, M. Fromowitz, A. Slocombe, A.L. Perez and D.J. Paustenbach. 2011. Product Sustainability: The Role of Chemical "Watch" Lists in Chemical Deselection from Products Manufacturing Processes. Society of Toxicology (SOT) Annual Meeting. March 6-10, 2011. Washington, D.C.
23. Adams, R., A.L. Perez, B. Donovan, D. Fillos and E.P. Donovan. 2011. Evaluation of risks due to children's exposures to cadmium in consumer products. 2011. Abstract #2858. Society of Toxicology (SOT) Annual Meeting, Wednesday, March 9, 2011, Washington, D.C. – poster presentation.
24. Perez, A.L., E.P. Donovan, M.A. McKinley, M. Anderle de Sylor, K.A. Thuett. 2010. An analysis of global regulatory initiatives regarding pharmaceuticals and personal care products; the potential role of bioassays in risk assessment. Abstract # 1851. Society for Risk Analysis (SRA) Annual Meeting, Salt Lake City, UT. December 8, 2010 – platform presentation.
25. Perez, A.L., C.L. Chen, J.J. Keenan, W.D. Cyrs, B.L. Donovan, S.E. Serrano, L. Vishnevskaya and A.K. Madl. 2010. An analysis of the proposed benefits and risks of nanotechnology-enabled water treatment. Abstract # WP212. Society of Environmental Toxicology and Chemistry (SETAC) North America 31st Annual Meeting, Portland, OR. November 10, 2010 – poster presentation.
26. Hong, B, S. LaVoie, M. Lipton, S.M. Miller, A.L. Perez, B. Polacco, S. Purvine, E. Zink and A.O. Summers. 2009. Identifying biomarkers and mechanisms of toxic metal stress with global proteomics. Department of Energy - Environmental Remediation Science Program (ERSP), Lansdowne, VA. December 2009 – poster presentation.
27. Perez, A.L. and K.A. Anderson. 2007. Nickel Bioavailability Measured by Diffusive Gradient Thin-Films from a four year fertilizer field dose study. Association for Environmental & Health Sciences 17th Annual Meeting, San Diego, CA. March 2007 - platform presentation. Best student presentation award.
28. Perez, A.L. and K.A. Anderson. 2006. Effects of sub-region and variety in classification of geographic growing region using stable isotope and trace element profiling for three fruits. American Chemical Society (ACS) San Francisco, CA – platform presentation.
29. Perez, A.L. and K.A. Anderson. 2006. Bioavailable metal concentrations from a metal- rich fertilizer dose field study as measured by Diffusive Gradient Thin Films. ACS San Francisco, CA– platform presentation.
30. Perez, A.L. and K.A. Anderson. 2007. DGT adsorbed Cd from fertilizer field studies predicts plant availability and accumulation in soil. Society of Environmental Toxicology and Chemistry (SETAC) North America 28th Annual Meeting, Milwaukee, WI – platform presentation.
31. Perez, A.L. and K.A. Anderson. 2005. Bioavailable metal concentrations from a metal- rich fertilizer, dose field study as measured by Diffusive Gradient Thin Films. SETAC 26th Annual Meeting, Baltimore, MD – poster presentation.
32. Perez, A.L. and K.A. Anderson. 2004. Metal Distribution in Agricultural Soils Amended. World Congress SETAC, Portland, OR – poster presentation.
33. Perez, A.L., Biology Graduate Student Symposium – 2004-2006. Newport, OR. – invited speaker; platform presentation.

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT B TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

October 6, 2023
File No. 01204123.21-13

Mr. Baitong Chen
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Subject: Monthly DMS Committee Determination on Reaction Area Boundary
Chiquita Canyon Landfill – Castaic, California

Dear Mr. Chen:

In accordance with Condition Nos. 9a and 9b of the Stipulated Order of Abatement (SOFA) pertaining to the Chiquita Canyon Landfill (Landfill) (Case No. 6177-4), the DMS Committee has reviewed newly acquired applicable data recorded during the month of September 2023, considered revisions of the estimated extent of elevated temperature landfill (ETLF) conditions exhibited at the subject Facility (referred to as the "Reaction Area" limits), and has prepared this determination on potentially revising the Reaction Area map.

Attachment A presents the Drawing, titled "Reaction Area Map", prepared by SCS Engineers (SCS) and dated 10/6/23. The Drawing depicts the Reaction Area Boundary as prescribed in Condition No. 9a, which corresponds to the limits of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2 as a solid black line. The Drawing also depicts the estimated extent of ETLF conditions being experienced at the site based on the DMS Committee's review of scientific data as a dashed red line. As presented on the Drawing, because the estimated extent of ETLF conditions (dashed red line) is fully contained within the Reaction Area Boundary decreed in the SOFA (solid black line), the DMS Committee finds no basis to modify the Reaction Area boundary at this time. Please note the following:

- The rationale serving as the basis for considering adjustments and modifications to the Reaction Area Boundary (or the determination to maintain the decreed boundary), include:
  - Landfill gas (LFG) wellhead temperatures in excess of approximately 160 degrees F.
  - Poor gas quality (defined as methane levels of less than 30 percent) in conjunction with methane-to-carbon dioxide (CH_4:CO_2) ratios less than 1.0.
  - The concentration of hydrogen (H_2) in the LFG measured greater than 2 percent by volume.
  - Accelerated settlement of the landfill surface, defined as approximately 6 inches or greater within a 60-day period, and cracks in landfill cover.
  - First-hand observations of Landfill and/or SCS engineering, construction, and operations & maintenance (O&M) field personnel who are on-site related to: 1) atypical excess leachate quantities (presence and quantity of liquids); 2) instances of pressurized liquids emitting from the landfill surface, from boreholes during drilling, and from LFG wells; and,

3) the characteristic of the odors originating from the select areas of the waste footprint (often described as "chemical-like" and distinctly different from typical LFG or landfill working face odors).

- There was no dissenting opinion among the DMS Committee members regarding this monthly determination.

- Supporting data is presented on the Drawing included as Attachment A.

Please contact either of the undersigned if you have questions or require additional information.

Sincerely,

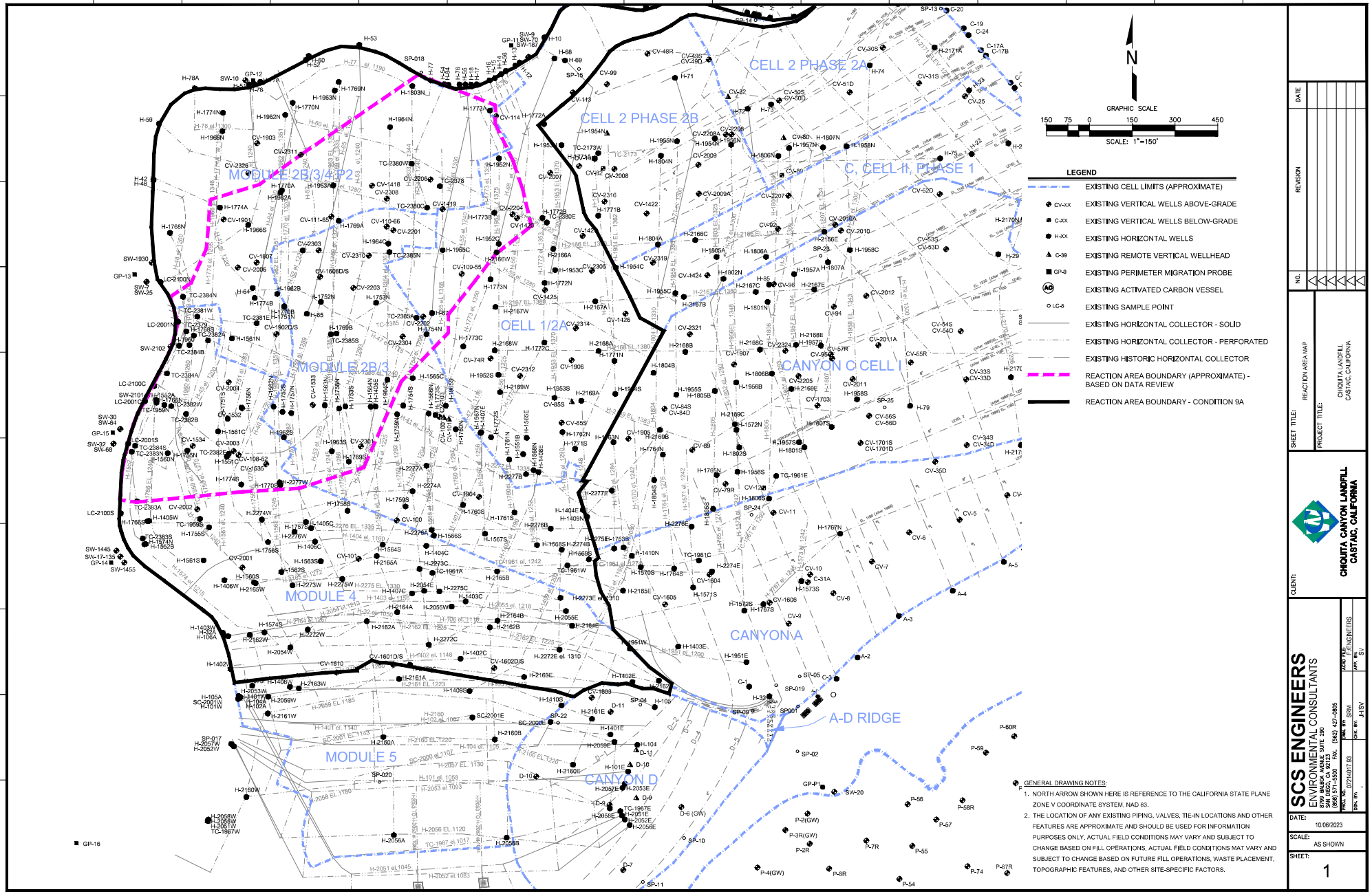
Robert E. Dick, PE, BCEE
Senior Vice President
SCS Engineers

Patrick S. Sullivan, BCES, CCP
Senior Vice President
SCS Engineers

RED/PSS

cc: Nathaniel Dickel, SCAQMD
Christina Ojeda, SCAQMD
Pablo Sanchez Soria, PhD, CIH, CTEH
Neal Bolton, PE, Blue Ridge Services, Inc.
Angie Perez, PhD, CIH, CTEH
Srividhya Viswanathan, PE, SCS Engineers

Enclosure:
Attachment A – Reaction Area Map



GENERAL DRAWING NOTES:

1. NORTH ARROW SHOWN HERE IS REFERENCE TO THE CALIFORNIA STATE PLANE ZONE V COORDINATE SYSTEM, NAD 83.
2. THE LOCATION OF ANY EXISTING PIPING, VALVES, TIE-IN LOCATIONS AND OTHER FEATURES ARE APPROXIMATE AND SHOULD BE USED FOR INFORMATION PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAY VARY AND SUBJECT TO CHANGE BASED ON FILL OPERATIONS, ACTUAL FIELD CONDITIONS MAT VARY AND SUBJECT TO CHANGE BASED ON FUTURE FILL OPERATIONS, WASTE PLACEMENT, TOPOGRAPHIC FEATURES, AND OTHER SITE-SPECIFIC FACTORS.

NO.	REVISION	DATE

SHEET TITLE: REACTION AREA MAP

PROJECT TITLE: CHIQUITA LANDFILL CASTAIC, CALIFORNIA

CLIENT: CHIQUITA CANYON LANDFILL CASTAIC, CALIFORNIA

SCS ENGINEERS
ENVIRONMENTAL CONSULTANTS
8799 BALBOA AVENUE, SUITE 290
SAN DIEGO, CA 92123
(858) 571-3500 FAX: (562) 427-0905

PROJ. NO. 07214017.83 | DSN. BY: SPM | ACAD FILE: - | CHK. BY: JHSV | APP. BY: SV

DATE: 10/06/2023

SCALE: AS SHOWN

SHEET: 1

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT C TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

November 6, 2023
File No. 01204123.21-13

Mr. Baitong Chen
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Subject: Monthly DMS Committee Determination on Reaction Area Boundary
Chiquita Canyon Landfill – Castaic, California

Dear Mr. Chen:

In accordance with Condition Nos. 9a and 9b of the Stipulated Order of Abatement (SOFA) pertaining to the Chiquita Canyon Landfill (Landfill or Facility) (Case No. 6177-4), the DMS Committee has reviewed newly acquired applicable data recorded during the month of October 2023, considered revisions of the estimated extent of elevated temperature landfill (ETLF) conditions exhibited at the subject Facility (referred to as the "Reaction Area" limits), and has prepared this determination on potentially revising the Reaction Area map.

Attachment A presents the Drawing, titled "Reaction Area Map", prepared by SCS Engineers (SCS) and dated 11/6/23. The Drawing depicts the Reaction Area boundary as prescribed in Condition No. 9a, which corresponds to the limits of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2 as a solid black line. The Drawing also depicts the estimated extent of ETLF conditions being experienced at the site based on the DMS Committee's review of scientific data as a dashed magenta line. As presented on the Drawing, because the estimated extent of ETLF conditions (dashed magenta line) is fully contained within the Reaction Area boundary decreed in the SOFA (solid black line), the DMS Committee finds no basis to modify the Reaction Area boundary at this time. Please note the following:

- The rationale serving as the basis for considering adjustments and modifications to the Reaction Area boundary (or the determination to maintain the decreed boundary), include:
  - Landfill gas (LFG) wellhead temperatures in excess of approximately 160 degrees Fahrenheit.
  - Poor gas quality (defined as methane levels of less than 30 percent) in conjunction with methane-to-carbon dioxide (CH_4:CO_2) ratios less than 1.0.
  - The concentration of hydrogen (H_2) in the LFG measured greater than 2 percent by volume.
  - Accelerated settlement of the landfill surface, defined as approximately 6 inches or greater within a 60-day period, and cracks in landfill cover.
  - First-hand observations of Landfill and/or SCS engineering, construction, and operations and maintenance (O&M) field personnel who are on-site related to: 1) atypical excess

leachate quantities (presence and quantity of liquids); 2) instances of pressurized liquids emitting from the landfill surface, from boreholes during drilling, and from LFG wells; and, 3) the characteristics of the odors originating from the select areas of the waste footprint (often described as "chemical-like" and distinctly different from typical LFG or landfill working face odors).

- There was no dissenting opinion among the DMS Committee members regarding this monthly determination.

- Supporting data is presented on the Drawing included as Attachment A.

Please contact either of the undersigned if you have questions or require additional information.

Sincerely,

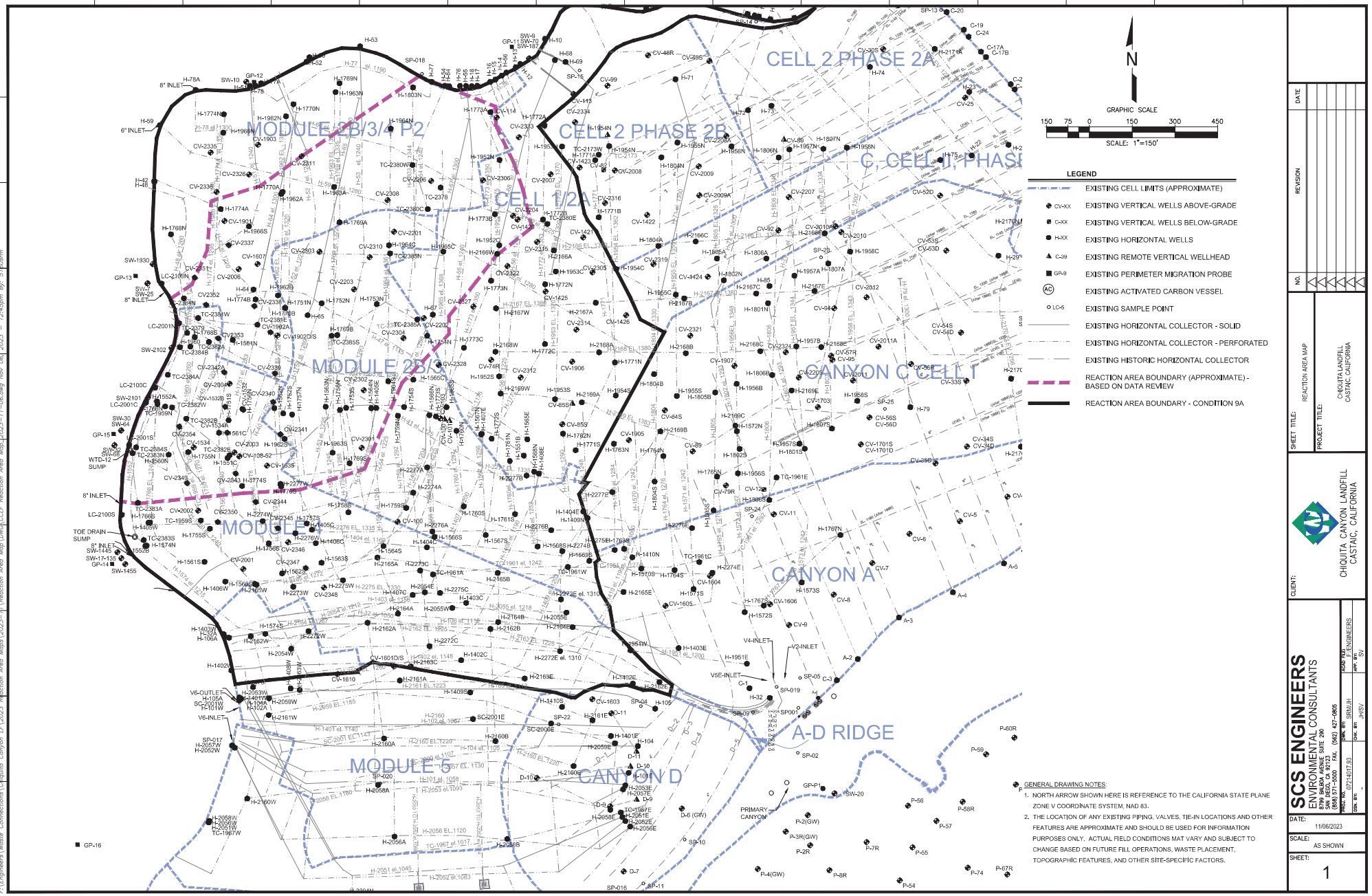
Robert E. Dick, PE, BCEE
Senior Vice President
SCS Engineers

Patrick S. Sullivan, BCES, CCP
Senior Vice President
SCS Engineers

RED/PSS

cc: Nathaniel Dickel, SCAQMD
Christina Ojeda, SCAQMD
Pablo Sanchez Soria, PhD, CIH, CTEH
Neal Bolton, PE, Blue Ridge Services, Inc.
Angie Perez, PhD, CIH, CTEH
Srividhya Viswanathan, PE, SCS Engineers

Enclosure:
Attachment A – Reaction Area Map


CELL 2 PHASE 2A
CELL 2 PHASE 2B
C, CELL II, PHASE
CELL 1/2A
MODULE 2B/3/4 P2
MODULE 2B/3
CANYON C CELL I
MODULE 4
CANYON A
A-D RIDGE
MODULE 5
CANYON D
N
GRAPHIC SCALE
150 75 0 150 300 450
SCALE: 1"=150'
LEGEND
EXISTING CELL LIMITS (APPROXIMATE)
CV-XX EXISTING VERTICAL WELLS ABOVE-GRADE
C-XX EXISTING VERTICAL WELLS BELOW-GRADE
H-XX EXISTING HORIZONTAL WELLS
C-39 EXISTING REMOTE VERTICAL WELLHEAD
GP-9 EXISTING PERIMETER MIGRATION PROBE
AC EXISTING ACTIVATED CARBON VESSEL
LC-5 EXISTING SAMPLE POINT
EXISTING HORIZONTAL COLLECTOR - SOLID
EXISTING HORIZONTAL COLLECTOR - PERFORATED
EXISTING HISTORIC HORIZONTAL COLLECTOR
REACTION AREA BOUNDARY (APPROXIMATE) - BASED ON DATA REVIEW
REACTION AREA BOUNDARY - CONDITION 9A
GENERAL DRAWING NOTES:
1. NORTH ARROW SHOWN HERE IS REFERENCE TO THE CALIFORNIA STATE PLANE ZONE V COORDINATE SYSTEM, NAD 83.
2. THE LOCATION OF ANY EXISTING PIPING, VALVES, TIE-IN LOCATIONS AND OTHER FEATURES ARE APPROXIMATE AND SHOULD BE USED FOR INFORMATION PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAT VARY AND SUBJECT TO CHANGE BASED ON FUTURE FILL OPERATIONS, WASTE PLACEMENT, TOPOGRAPHIC FEATURES, AND OTHER SITE-SPECIFIC FACTORS.
SCS ENGINEERS
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(858) 571-5500 FAX: (562) 427-0805
PROJECT NO. 07214017.83
DRAWN BY: SRM/JH
CHK'D BY: JH/SV
APP. BY: SV
P.E. ENGINEERS
DATE: 11/06/2023
SCALE: AS SHOWN
SHEET: 1
NO. REVISION DATE
SHEET TITLE: REACTION AREA MAP
PROJECT TITLE: CHIQUITA LANDFILL CASTAIC, CALIFORNIA
CLIENT: CHIQUITA CANYON LANDFILL CASTAIC, CALIFORNIA
F:\Engineers\Waste Connections\Chiquita Canyon LF\2023 Reaction Area Maps\2023-11\Reaction Area Map\DWG\CCLF Reaction Area Map_2023-11-06.dwg Nov 06, 2023 - 12:45pm By: 51storm

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT D TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

December 6, 2023
File No. 01204123.21-13

Mr. Baitong Chen
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Subject: Monthly DMS Committee Determination on Reaction Area Boundary
Chiquita Canyon Landfill – Castaic, California

Dear Mr. Chen:

In accordance with Condition Nos. 9a and 9b of the Stipulated Order of Abatement (SOFA) pertaining to the Chiquita Canyon Landfill (Landfill or Facility) (Case No. 6177-4), the DMS Committee has reviewed newly acquired applicable data recorded during the month of November 2023, considered revisions of the estimated extent of elevated temperature landfill (ETLF) conditions exhibited at the subject Facility (referred to as the "Reaction Area" limits), and has prepared this determination on potentially revising the Reaction Area map.

Attachment A presents the Drawing, titled "Reaction Area Map", prepared by SCS Engineers (SCS) and dated 12/6/23. The Drawing depicts the Reaction Area boundary as prescribed in Condition No. 9a, which corresponds to the limits of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2 as a solid black line. The Drawing also depicts the estimated extent of ETLF conditions being experienced at the site based on the DMS Committee's review of scientific data as a dashed magenta line. As presented on the Drawing, the estimated extent of ETLF conditions (dashed magenta line) is fully contained within the Reaction Area boundary decreed in the SOFA (solid black line). Although the dashed magenta line has been modified since the DMS Committee's prior monthly review to incorporate one additional landfill gas well, because these ETLF conditions are fully contained within the Reaction Area boundary and have not expanded into a new cell, the DMS Committee finds no basis to modify the Reaction Area boundary at this time. Please note the following:

- The rationale serving as the basis for considering adjustments and modifications to the Reaction Area boundary (or the determination to maintain the decreed boundary), include:
  - Landfill gas (LFG) wellhead temperatures in excess of approximately 160 degrees Fahrenheit.
  - Poor gas quality (defined as methane levels of less than 30 percent) in conjunction with methane-to-carbon dioxide (CH_4:CO_2) ratios less than 1.0.
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- Supporting data is presented on the Drawing included as Attachment A.

Please contact either of the undersigned if you have questions or require additional information.

Sincerely,

Robert E. Dick, PE, BCEE
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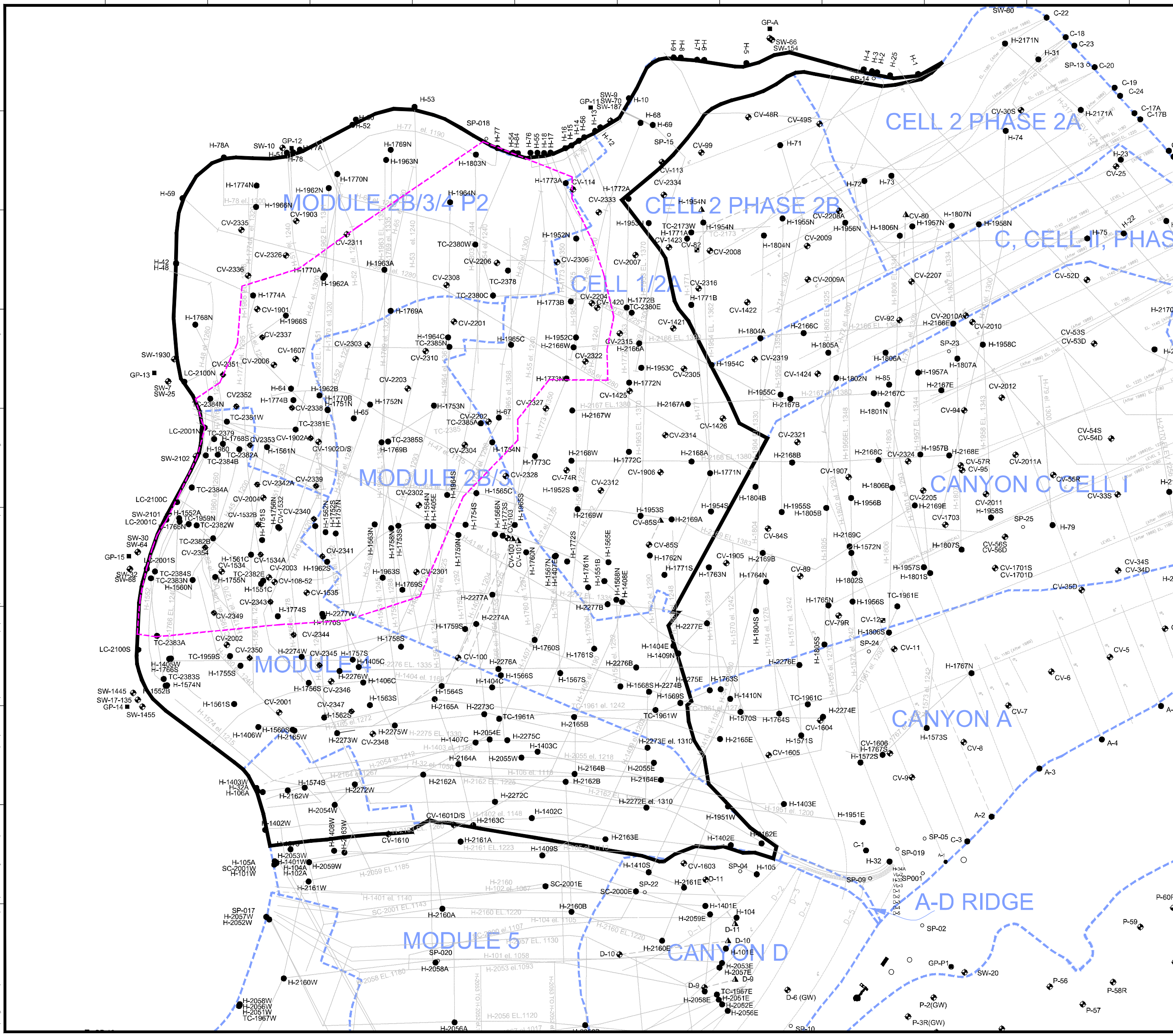
Enclosure:
Attachment A – Reaction Area Map



LEGEND

- EXISTING CELL LIMITS (APPROXIMATE)
- CV-XX EXISTING VERTICAL WELLS ABOVE-GRADE
- CV-XX EXISTING VERTICAL WELLS BELOW-GRADE
- H-XX EXISTING HORIZONTAL WELLS
- CV-XX EXISTING REMOTE VERTICAL WELLHEAD
- GP-XX EXISTING PERIMETER MIGRATION PROBE
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- EXISTING HISTORIC HORIZONTAL COLLECTOR
- REACTION AREA BOUNDARY (APPROXIMATE) - BASED ON DATA REVIEW
- REACTION AREA BOUNDARY - CONDITION 9A

GENERAL DRAWING NOTES:

1. NORTH ARROW SHOWN HERE IS REFERENCE TO THE CALIFORNIA STATE PLANE ZONE V COORDINATE SYSTEM, NAD 83.
2. THE LOCATION OF ANY EXISTING PIPING, VALVES, TIE-IN LOCATIONS AND OTHER FEATURES ARE APPROXIMATE AND SHOULD BE USED FOR INFORMATION PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAY VARY AND SUBJECT TO CHANGE BASED ON FUTURE FILL OPERATIONS, WASTE PLACEMENT, TOPOGRAPHIC FEATURES, AND OTHER SITE-SPECIFIC FACTORS.

NO.	REVISION	DATE

SHEET TITLE: REACTION AREA MAP

PROJECT TITLE: CHIQUITA LANDFILL CASTAIC, CALIFORNIA

CLIENT: CHIQUITA CANYON LANDFILL CASTAIC, CALIFORNIA

SCS ENGINEERS
ENVIRONMENTAL CONSULTANTS
8799 BALBOA AVENUE SUITE 290
SAN DIEGO, CA 92123
(858) 571-5500 FAX. (562) 427-0805

PROJ. NO. 07214017.93 | DSN. BY: - | DWN. BY: SRM/JH | CHK. BY: JH/WH | ACAD FILE: F:\ENGINEERS | APP. BY: WH

DATE: 12/06/2023

SCALE: AS SHOWN

SHEET: 1

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT E TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

January 5, 2024
File No. 01204123.21-13

Mr. Baitong Chen
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Subject: Monthly DMS Committee Determination on Reaction Area Boundary
Chiquita Canyon Landfill – Castaic, California

Dear Mr. Chen:

In accordance with Condition Nos. 9a and 9b of the Stipulated Order of Abatement (SOFA) pertaining to the Chiquita Canyon Landfill (Landfill or Facility) (Case No. 6177-4), the DMS Committee has reviewed newly acquired applicable data recorded during the month of December 2023, considered revisions of the estimated extent of elevated temperature landfill (ETLF) conditions exhibited at the subject Facility (referred to as the "Reaction Area" limits), and has prepared this determination on potentially revising the Reaction Area map.

Attachment A presents the Drawing, titled "Reaction Area Map", prepared by SCS Engineers (SCS) and dated 1/5/24. The Drawing depicts the Reaction Area boundary as prescribed in Condition No. 9a, which corresponds to the limits of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2 as a solid black line. The Drawing also depicts the estimated extent of ETLF conditions being experienced at the site based on the DMS Committee's review of scientific data as a dashed magenta line. Data from the past month shows that there are some areas within the dashed magenta line that no longer exhibit any of the criteria conditions listed below. However, the DMS Committee feels that it is prudent to maintain the dashed magenta line in its current position for this month to enable evaluation as to whether this constitutes a trend of contraction of ETLF conditions over the next several months. As presented on the Drawing, the estimated extent of ETLF conditions (dashed magenta line) is fully contained within the Reaction Area boundary decreed in the SOFA (solid black line). Because the ETLF conditions are fully contained within the Reaction Area boundary and have not expanded into a new cell, the DMS Committee finds no basis to modify the Reaction Area boundary at this time. Please note the following:

- The rationale serving as the basis for considering adjustments and modifications to the Reaction Area boundary (or the determination to maintain the decreed boundary), include:

  - Landfill gas (LFG) wellhead temperatures in excess of approximately 160 degrees Fahrenheit.

  - Poor gas quality (defined as methane levels of less than 30 percent) in conjunction with methane-to-carbon dioxide (CH_4:CO_2) ratios less than 1.0.

  - The concentration of hydrogen (H_2) in the LFG measured greater than 2 percent by volume.

- Accelerated settlement of the landfill surface, defined as approximately 6 inches or greater within a 60-day period, and cracks in landfill cover.

- First-hand observations of Landfill and/or SCS engineering, construction, and operations and maintenance (O&M) field personnel who are on-site related to: 1) atypical excess leachate quantities (presence and quantity of liquids); 2) instances of pressurized liquids emitting from the landfill surface, from boreholes during drilling, and from LFG wells; and, 3) the characteristics of the odors originating from the select areas of the waste footprint (often described as "chemical-like" and distinctly different from typical LFG or landfill working face odors).

- There was no dissenting opinion among the DMS Committee members regarding this monthly determination.

- Supporting data is presented on the Drawing included as Attachment A.

Please contact either of the undersigned if you have questions or require additional information.

Sincerely,

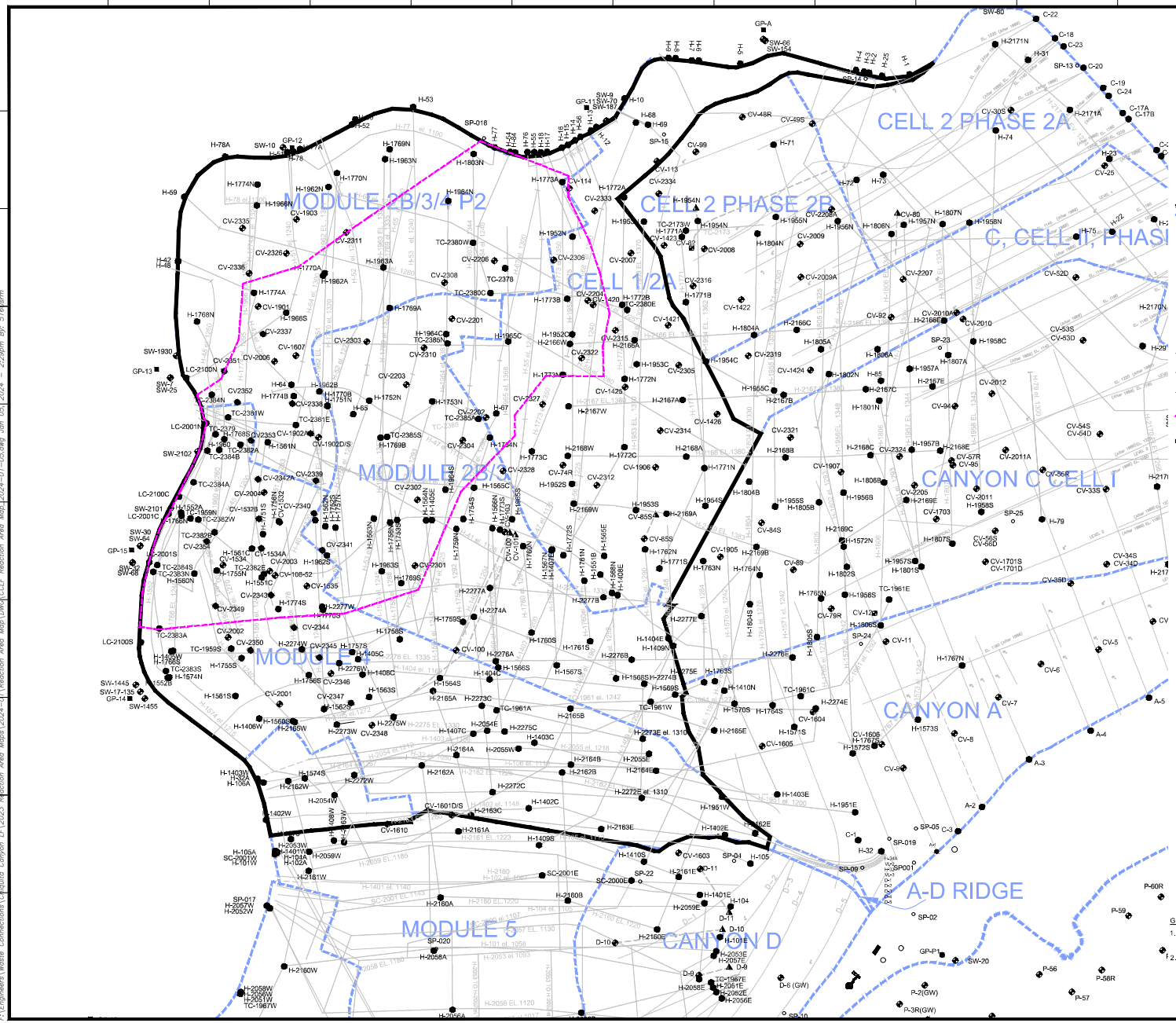
Robert E. Dick, PE, BCEE
Senior Vice President
SCS Engineers

Patrick S. Sullivan, BCES, CCP
Senior Vice President
SCS Engineers

RED/PSS

cc: Nathaniel Dickel, SCAQMD
Christina Ojeda, SCAQMD
Pablo Sanchez Soria, PhD, CIH, CTEH
Neal Bolton, PE, Blue Ridge Services, Inc.
Angie Perez, PhD, CIH, CTEH
Srividhya Viswanathan, PE, SCS Engineers

Enclosure:
Attachment A – Reaction Area Map



GENERAL DRAWING NOTES:

1. NORTH ARROW SHOWN HERE IS REFERENCE TO THE CALIFORNIA STATE PLANE ZONE V COORDINATE SYSTEM, NAD 83.
2. THE LOCATION OF ANY EXISTING PIPING, VALVES, TIE-IN LOCATIONS AND OTHER FEATURES ARE APPROXIMATE AND SHOULD BE USED FOR INFORMATION PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAT VARY AND SUBJECT TO CHANGE BASED ON FUTURE FILL OPERATIONS, WASTE PLACEMENT, TOPOGRAPHIC FEATURES, AND OTHER SITE-SPECIFIC FACTORS.

NO.	REVISION	DATE

SHEET TITLE: REACTION AREA MAP

PROJECT TITLE: CHIQUITA LANDFILL CASTAIC, CALIFORNIA

CLIENT: CHIQUITA CANYON LANDFILL CASTAIC, CALIFORNIA

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PROJECT NO. 07214017.83 | DSNR. BY: SRMUH | ACAD FILE: P:\ENGINEERS | CHK. BY: JWMCH | APP. BY: WCH | DSN. BY: -

DATE: 01/05/2024

SCALE: AS SHOWN

SHEET: 1

BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT F TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

Elevated Temperature Landfill Causation Investigation Report

Chiquita Canyon Landfill
Castaic, California
SCAQMD Facility No. 119219

Waste Connections
29201 Henry Mayo Drive
Castaic, CA 91384

Submitted to:

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765
909-396-2000

SCS ENGINEERS

01204123.21-13 | **December 8, 2023**

15521 Midlothian Turnpike, Suite 305
Midlothian, VA 23113
804-378-7440

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Appendices

1 INTRODUCTION

Chiquita Canyon, LLC (Chiquita) operates a municipal solid waste (MSW) landfill/solid waste disposal facility located in Castaic, California under South Coast Air Quality Management District (SCAQMD) Facility No. 119219. SCS Engineers (SCS) prepared this Elevated Temperature Landfill Causation Investigation Report (Report), which is being submitted to SCAQMD on behalf of Chiquita, in accordance with Condition No. 12(b)(ii) of the Stipulated Order of Abatement (SOFA) (Case No. 6177-4) pertaining to the Chiquita Canyon Landfill (CCL, Facility or Landfill), which was approved on September 6, 2023.

SCS' opinion is that a discrete portion of the waste mass at the Landfill is experiencing elevated temperature landfill (ETLF) conditions. This opinion was expressed and expanded upon during testimony by SCS personnel at the SCAQMD Hearing Board for the SOFA hearing conducted on 9/6/23, which was recorded and can be viewed at the following link:

http://www.aqmd.gov/home/news-events/webcast/live-webcast?ms=MjU87i4XsjM

ETLF conditions can generally be characterized as when the typical waste decomposition processes and corresponding methanogenesis associated with anaerobic digestion of organic solid waste materials disposed in a landfill are impeded because of heat accumulation. As a result, certain abiotic (non-biological) processes and chemical reactions within the buried wastes occur instead. Basically, heat starts to degrade the waste instead of the microbes that normally do.

Condition No. 12 requires Chiquita, through the DMS Committee, to conduct an investigation and study into the cause of the landfill reaction, , which shall include:

> *An investigation and report on 1) the cause of the alleged chemical reaction(s) resulting in the elevated well temperatures, elevated levels of DMS formation in the landfill gas, and elevated levels of NMOC formation in the landfill gas and 2) solutions to slow and stop the reaction(s) in the landfill. Investigation into the cause of the alleged chemical reaction(s) shall include, but not be limited to, waste characterization study of waste disposed within the Reaction Area, to the extent records of such waste are within Respondent's possession, including (but not limited to) analysis of chemical and physical characteristics, BTU, moisture content, biological methane potential. Respondent shall also conduct drill core sampling in the Reaction Area (as defined in Condition 9(a)) to assess waste characterization in areas not affected by elevated temperatures at the time of drilling.*

This Report presents the investigation and study into the potential causes of the ETLF conditions at the Landfill, as well as corrective measures to contain and manage the ETLF conditions, pursuant to SOFA Condition 12(b)(ii). For purposes of this Report, the terms "ETLF conditions", "landfill reaction", and "heating event" are synonymous.

SCS finds that the causes of the ETLF conditions at CCL cannot be definitively identified. It is likely that the heat generated within the waste mass from typical anaerobic digestion processes accumulated to a point, inhibiting the second stage of fermentation, acetogenesis, and methanogenesis processes, and were replaced by abiotic chemical reactions affiliated with ETLFs that became self-sustaining.

2 BACKGROUND – TYPICAL MSW DECOMPOSITION PROCESSES AND ELEVATED TEMPERATURE LANDFILL CHARACTERISTICS

CCL is located at 29201 Henry Mayo Drive, Castaic, California, in northern Los Angeles County. It is a Class III non-hazardous MSW landfill and operates under Solid Waste Facilities Permit (SWFP) No. 19-AA-0052, issued by CalRecycle (formerly the California Integrated Waste Management Board [CIWMB]). CCL accepts nonhazardous solid waste, including MSW from various areas within Los Angeles County in accordance with Title 27 of the California Code of Regulations (27 CCR), Section 20005, et seq.

The site commenced operations in 1972. The permitted landfill disposal footprint totals 639 acres and is comprised of 3 separate areas designated as Primary Canyon, Canyon B, and the Main Canyon (including Canyons A, C, D, subsequent fill modules, and Cells 6, 7, 8, 9, 10, 11, 12, and 13). Cells 6 through 13 remain to be constructed per the expansion plan approved by Los Angeles Department of Regional Planning in July 2017. Cells 6 and 8 are located southwest of Canyon D. Cells 7, 9, 10, 12, and 13 are located northeast of the active area and Cell 11 is located north of the active area. Currently, 253 acres of the footprint have been used for disposal and Cell 6 (16 acres) is currently under construction. All areas except Primary Canyon have landfill liners and leachate collection systems.

Per CalRecycle's solid waste facility listing for CCL, the maximum permitted throughput of any combination of non-hazardous solid waste, beneficial reuse material, and composting green material is 12,000 tons per operating day, the design capacity is 110.366 million cubic yards and the estimated closure date is 2047. The Landfill currently accepts approximately 1.5 million tons per year of MSW.

Leachate is collected and transported off-site for disposal. The landfill gas (LFG) collection and control system was originally installed in Primary Canyon and Canyon B in 1989 and the LFG system was subsequently expanded into the Main Canyon and has been routinely upgraded and expanded over the years.

This Report focuses on the northwestern area of the Landfill, comprised of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2 (of the Main Canyon), which are exhibiting ETLF conditions. A drawing depicting the relevant areas of the Facility is included in **Appendix A**.

TYPICAL MSW DECOMPOSITION PROCESSES

The decomposition of MSW within a landfill typically involves an initial aerobic phase followed by an anaerobic phase. The primary processes that occur within these two phases are hydrolysis, fermentation, acetogenesis, and methanogenesis. Detailed explanations of these processes and the corresponding chemical reactions associated with each are well-documented in existing literature (peer-reviewed published papers, technical journal articles, etc.) relevant to the solid waste industry. Examples of the available literature on waste decomposition processes related to both the typical aerobic and anaerobic phases as well as the atypical ETLF reactions[i,ii,iii] include the papers and articles cited in **Appendix B**, among many other reference documents. For purposes of this Report, a generalized summary of typical waste decomposition, along with key points related to temperature, are presented below.

Landfill Gas Production

At a typical MSW landfill, microbial colonies decompose or digest the organic waste fraction (e.g., wood, paper, textiles, vegetative matter, food waste) and produce LFG comprised mostly of methane and carbon dioxide, with trace concentrations of volatile organic compounds (VOCs), reduced sulfur compounds (such as hydrogen sulfide), and other chemical constituents. The production of LFG as a byproduct of anaerobic digestion of organic waste materials by microbial colonies in MSW, which is often referred to as methanogenesis due to the generation of methane as the primary component of LFG, is well-understood within the solid waste industry.[iv,v] The metabolic synthesis of organic waste by specific types of microbial communities that constitute the methanogenesis processes are well-documented in the literature addressing anaerobic digestion, and various algorithms and models have been developed as tools to estimate the quantity (both mass-based and volume-based quantities) of LFG that will be generated by the decomposition of wastes with a known composition.

Methanogenic bacteria that synthesize organic wastes to produce methane and other byproducts that comprise LFG (commonly referred to as methanogens) are actually comprised of numerous and diversified microbial organisms. Research suggests that microbes are able to facilitate substantial methane production at low pH, which occurs in the acid-forming phase of ETLF conditions.[iv] The stages of LFG production are well documented throughout the literature.[v,vi]

As stated in various papers,[vii] the stage immediately following consumption of the entrained oxygen yields formation of volatile fatty acids (such as acetic acid) and hydrogen (H_2), which is then used as an energy source and electron donor by methanobacterium. The ASTDR document title "Landfill Gas Primer; An Overview for Environmental Health Professionals," dated November 2001, provides a summary of the four phases of MSW degradation and LFG generation.[vi]

While select organisms classified as methanogens are mesophiles and achieve optimal function in temperatures less than 120°F, certain methanogens function in anaerobic environments with sustained temperatures above 180°F.[viii]

Leachate Production

As noted in the available literature, water produced during the initial aerobic phase of decomposition is subsequently consumed in the anaerobic phase. Accordingly, the sources of leachate generated within a typical MSW landfill are primarily the moisture entrained in the incoming waste materials and precipitation that infiltrates into the waste mass. Water produced by the chemical reactions associated with decomposition processes is relatively insignificant compared to overall leachate generation.

CHARACTERISTICS OF ELEVATED TEMPERATURE LANDFILLS

ETLFs are a relatively recent development in the industry. The first known ETLF event at a landfill in the U.S. occurred around 2008. The landfill industry has documented approximately 10 to 15 landfills that have experienced a heating event in which nearly all of the waste mass (or at least a significant majority) exhibits ETLF conditions. There are also approximately 40 other landfills that have a smaller portion of their waste mass exhibiting ETLF conditions.

At an ETLF, the landfill experiences increased heat accumulation that impacts the microbial colonies' ability to decompose the waste as normal. An ETLF undergoes a different decomposition process that involves abiotic (meaning non-biological) processes. These abiotic processes produce LFG with a different composition than normal (such as increased presence of hydrogen and dimethyl sulfide

(DMS) and other constituents that are not present in large amounts at normal landfills). In addition to elevated temperatures, ETLFs experience high pressures, broad settlement (an indication of significant waste degradation and settlement), an inverted methane to carbon dioxide ratio in the LFG, as well as increased gas generation and increased liquids production.

The MSW landfills that have experienced large-scale heating events share a few common physical properties. In general, they have relatively large waste footprint areas (typically at least 100 acres or more of waste in-place), they have relatively deep waste profiles (typically at least 200 feet of waste depth), and they have excessive free liquids (the moisture content is greater than field capacity).

The most recognizable characteristics (i.e., symptoms) of an ETLF are as follows:

- Increased gas, leachate, and in-situ waste temperatures. The in-situ waste temperatures conform to the "belly-curve" profile in which the maximum temperatures occur at approximately two-thirds of the maximum waste depth.

- Increase in gas production (significantly greater quantities), increase in subsurface gas pressures, and changes in gas composition. The changes in gas composition relative to normal LFG often involve a decrease in methane concentration, an increase in hydrogen concentration, an increase in DMS concentration, and increases in certain trace constituents, such as benzene and acetone.

- A change in the odor characteristics of the gas (often described as a "chemical" odor) compared to typical LFG. Where normal LFG often has a pungent skunk odor, or a rotten egg odor associated with hydrogen sulfide, the gas produced at ETLF sites is somewhat peculiar and noticeably different.

- Increase in leachate quantities, evidence of pressurized liquids, and changes in leachate composition; the changes in leachate composition relative to normal leachate often involve increases in BOD and COD concentrations, increased solids concentrations, increases in certain organic constituents, such as benzene and acetone, and decreased pH.

- Accelerated widespread landfill settlement across the affected area (as opposed to highly localized rapid settlement).

Reaction Gas Production

The production of gas within a landfill in which a discrete portion of the waste mass is exhibiting multiple characteristics that are consistent with ETLF conditions, as generally recognized by professionals in the solid waste industry, is not as well-understood as the typical LFG production processes. ETLF conditions generally occur when the typical waste decomposition processes and corresponding methanogenesis associated with anaerobic digestion of solid waste materials disposed in a landfill are impeded because of heat accumulation. Note that heat accumulation is not synonymous with heat generation, or necessarily a direct consequence of heat generation. As a result, certain abiotic (non-biological) processes and reactions within the buried wastes occur instead. For purposes of this discussion, the gas produced within an ETLF by abiotic processes will be referred to as "Reaction Gas" (RG) to distinguish it from typical LFG produced by traditional methanogenesis.

As noted above, the RG produced at ETLFs often exhibits low oxygen, reduced methane concentrations, elevated carbon dioxide, elevated hydrogen, elevated DMS, and elevated

temperatures. ETLFs also experience tendencies to remain in the acid-forming stage of LFG production. However, the presence of some methane indicates that methanogenesis associated with anerobic decomposition is still occurring.

The exact processes and reactions involved in production of RG are not comprehensively well-documented within the literature and corresponding algorithms and models to estimate the quantity of RG are not readily available (specifically no models have been empirically confirmed by field measurements). The use of a first-order decay model similar to LandGEM to estimate projected RG flowrates may not be appropriate because the microbes are not metabolically synthesizing the waste as during traditional methanogenesis.

Accordingly, engineering design exercises for sizing equipment to combust a gas stream that is a composite of LFG and RG typically consider the following:

- ETLF conditions increase composite gas (LFG+RG) quantities (on a volumetric flowrate basis) because the increase in temperature expands gas volume in accordance with the ideal gas law (pV=nRT).

- ETLF conditions decrease LFG quantities (on both a mass and volumetric basis) because the increased heat present within the waste matrix distresses certain species of methanogens (those that are characterized as mesophilic) and impedes their metabolic synthesis of the waste materials that produces LFG. However, some practitioners have put forth an opinion that the mass of methane remains consistent but the concentration decreases due to the increased quantity of gas generation.[ix]

- RG, as a byproduct of abiotic processes and reactions, may potentially be produced in greater quantity than LFG produced by anaerobic digestion from the same amount of solid waste. While not a direct comparison, the pyrolytic gas yield of the organic fraction of MSW has been demonstrated to be significantly greater than the pyrolytic gas yield of anaerobic digestion (AD) solid residuals (digestate).[x]

While generation of DMS, along with other reduced sulfur compounds such as hydrogen sulfide, is common at MSW landfills, several ETLF sites have experienced a pronounced increase in DMS generation. The formation of hydrogen sulfide by sulfate reducing bacteria (SRB) within a landfill environment is well-documented within the industry literature references. However, the cause of elevated DMS at ETLF sites is somewhat less certain and research on simulated landfills noted that "DMS generation was active in the acidification and methane fermentation phase of the simulated landfill and was possibly affected by the volatile fatty acid concentration, chemical oxygen demand, total organic carbon concentration and pH of the leachate, as well as total organic carbon in the refuse."[xi]

Reaction Leachate Production

ETLF sites experience a significant increase in leachate production within the Landfill waste mass, which is likely attributed to multiple circumstances, including: 1) a reduction in field capacity of the waste materials (which diminishes the moisture attenuation abilities); 2) when the anerobic phase is inhibited due to heat accumulation, the water produced during the aerobic phase is not consumed at the normal rate; 3) certain other synthesis reactions may be occurring to produce water, especially considering the availability of hydrogen; and, 4) the heat present may facilitate pyrolytic reactions that produce condensable liquids. As noted previously, the strength of the leachate increases significantly at ETLFs. Because the solubility of solids increases with increases in temperature, the

heat enables constituents from the buried wastes to solubilize more readily, which results in an increase the concentration of certain constituents in the leachate, such as BOD, COD, and various speciated organic compounds.

3 CAUSES OF ELEVATED TEMPERATURE LANDFILL REACTION

Condition 12(b)(ii) requires investigation on the cause of the alleged chemical reaction(s) resulting in the elevated well temperatures, elevated levels of DMS formation in the landfill gas, and elevated levels of NMOC formation in the landfill gas. A discussion of the chemical reactions that potentially contribute to elevated well temperatures, elevated levels of DMS formation, and elevated NMOC formation in the landfill gas are presented in this section.

The landfill industry has concluded that the exact causes and contributing factors to the heat accumulation and ultimate formation of large-scale heating events and the chemical reactions associated with ETLFs are believed to be different and somewhat unique from landfill to landfill. The "original cause" or "triggering event" at ETLFs is not always obvious because the occurrence is infrequent and there are many MSW landfills that have similar waste streams and are large, deep, and wet, but do not exhibit ETLF conditions.

A potential contributing factor that enables ETLF conditions to develop is where the LFG collection systems and liquids removal systems (leachate collection and/or LFG wellfield dewatering) have experienced some degree of reduced efficiency and performance for an extended period of time.

As noted previously, there are a number of biological and chemical processes that can occur naturally in a landfill environment and can contribute to warm temperature conditions similar to those the Facility is experiencing. The most significant heat-producer in a typical MSW landfill is biological decomposition which creates hydrogen, then methane and carbon dioxide. Heat is removed from the waste mass by gas and liquid extraction and by convection/conduction of heat to the outside environment or the ground underneath the waste. Other sources of heat generation documented in the industry literature references include:[ii]

- Anaerobic, exothermic metal corrosion and oxidation reactions;
- Hydration and carbonation of various oxides/hydroxides;
- Acid-base neutralizations; and,
- Pyrolysis.

Notable documented heating events that have occurred within MSW landfills in the United States can generally be categorized as follows:

- Landfills that have accepted significant quantities of aluminum dross or other types of secondary metals waste. The suspected cause of ETLF conditions at these sites has been attributed primarily to the generation and accumulation of heat from anaerobic, exothermic metals corrosion reactions associated with large deposits of select industrial metals-containing waste materials buried in the landfill in the presence of copious quantities of liquids. The manner in which heat is generated from anaerobic, exothermic metals corrosion is described in the industry literature references.

- Landfills that have accepted significant quantities of waste-to-energy incinerator ash, coal combustion residuals (CCR), and/or other industrial ash waste materials. The suspected cause of ETLF conditions at these sites has been attributed primarily to the generation and

accumulation of heat from ash hydration and carbonation reactions associated with large deposits of industrial ash containing various oxides/hydroxides buried in the landfill in the presence of copious quantities of liquids. The manner in which heat is released from ash hydration and carbonation is described in the industry literature references.

- Landfills that have accepted significant quantities of sludge/biosolids. The suspected cause of ETLF conditions at these sites has been attributed primarily to the generation and accumulation of heat due to the higher degradable organic carbon (DOC) content and the increased presence of free liquids under anaerobic conditions. The manner in which heat is released from anaerobic decomposition is described in the industry literature references.

- Landfills that have experienced a slope failure or other large-scale waste relocation in which a substantial portion of the buried wastes are "shocked" by an abrupt reversion from anaerobic conditions to aerobic conditions and, upon replacement of those wastes, back to anaerobic conditions. The suspected cause of ETLF conditions at these sites has been attributed primarily to the generation and accumulation of heat from essentially reverting to composting of the wastes under aerobic conditions. The manner in which heat is released from aerobic decomposition is described in the industry literature references.

- Landfills that have none of the four preceding attributes, and specifically did not accept significant quantities of industrial wastes containing metals or ash, biosolids, or other materials often designated within the landfill industry as "special wastes". The waste streams at these facilities can be described as exclusively (or at least predominantly) MSW containing the typical composition of household, residential, and commercial (business) wastes with perhaps a marginal quantity of construction and demolition debris (CDD) waste materials that are common at nearly all MSW landfills. The suspected cause of ETLF conditions at these sites, and the corresponding generation and accumulation of heat, cannot be readily identified. These landfills do conform to the common characteristics of large, deep, wet landfills, and may have been experiencing a period of less-than-optimal performance in their respective LFG collection systems and/or liquids removal systems. But it is difficult to ascribe the specific cause or trigger of the heating event to be due to these physical characteristics alone, since there exists hundreds of other landfills in the U.S. with similar physical characteristics that have not experienced a large-scale heating event and exhibited ETLF conditions.

CCL has not accepted significant quantities of industrial wastes containing metals or ash, biosolids, or other materials often designated within the landfill industry as "special wastes", which is consistent with SCS' experience that the majority of ETLF landfills fall into the last category listed above in which the suspected cause of ETLF conditions cannot be readily identified. Thus, it is SCS' opinion that CCL falls into the last category of landfills, where a cause cannot be definitively identified.

WASTE CHARACTERIZATION STUDY

Condition No. 12(b)(ii) provides: Investigation into the cause of the alleged chemical reaction(s) shall include, but not be limited to, waste characterization study of waste disposed within the Reaction Area, to the extent records of such waste are within Respondent's possession, including (but not limited to) analysis of chemical and physical characteristics, BTU, moisture content, biological methane potential.

The wastes within the Reaction Area were buried prior to Chiquita's ownership of the Landfill. Chiquita has conducted an internal review of all available records and was unable to locate any records related to the wastes placed within the Reaction Area, including waste manifests, weight tickets, or laboratory analyses reflecting the constituents/nature of the Reaction Area wastes (e.g. - scientific measurements for traits such as BTU value (heat content), biological methane potential (BMP), moisture content (as a percentage), and chemical content (cellulose, lignin, etc.)). As a result, SCS was unable to include a review of those types of records as part of its analysis.

DRILL CORE SAMPLING RESULTS

Condition No. 12(b)(ii) provides: Respondent shall also conduct drill core sampling in the Reaction Area (as defined in Condition 9(a)) to assess waste characterization in areas not affected by elevated temperatures at the time of drilling.

In order to evaluate whether the existing in-place buried waste contains specific waste materials known to contribute to heat generation, CCL provided the boring logs for 49 vertical LFG extraction wells that were installed at the Facility between 7/12/23 and 10/12/23. Confirmation that a subset of these wells are located "in areas not affected by elevated temperatures at the time of drilling", is as follows: 1) the temperatures of the drill cuttings at select boreholes are within the range of typical landfill (non-ETLF) conditions, based on the 40 CFR 63 Subpart AAAA regulatory threshold of 145°F (this is a conservative value); and, 2) the boreholes are positioned within the SOFA-prescribed Reaction Area boundary (depicted on monthly maps using a solid black line), but are outside of the estimated extent of ETLF conditions being experienced at the site based on review of scientific data (depicted as a dashed magenta line).

Of the 49 borings, the drill cuttings from 19 boreholes exhibited temperatures that did not exceed the regulatory threshold of 145°F, thus they do not appear to be affected by elevated temperatures. Also, of these 49 borings, 26 are physically located outside of the estimated extent of ETLF conditions impacting the site based on review of scientific data. A detailed inventory of which of the 49 wells satisfy this requirement based on either of the two criteria (drill cuttings temperatures and well physical positioning), is presented below in the **Table 1.**

Table 1. Inventory of LFG Well Boring Logs

Temp > 145°F	Well ID		
	Area Within Magenta line	**Area Between Magenta and Black lines**	**Area Outside of Black line**
Yes [30 total]	16 total 1532B, 1534A, 1902A, 2301, 2302, 2304, 2306, 2308, 2310, 2338, 2339, 2340, 2342A, 2343, 2352, 2353	8 total 2305, 2312, 2314, 2322, 2327, 2344, 2345, 2346	6 total 2009A, 2010A, 2208A, 2316, 2319, 2321
No [19 total]	7 total 2303, 2311, 2337, 2341, 2349, 2351, 2354	9 total 2315, 2326, 2328, 2333, 2335, 2336, 2347, 2348, 2350	3 total 2011A, 2324, 2334

These boring logs document observations recorded by SCS' construction quality assurance (CQA) personnel at each borehole for drill cuttings, which is a term used for waste materials removed from the borehole during the drilling process. Visual observations of the drill cuttings were reviewed for this Report. The observations noted by CQA personnel address four parameters: temperature, degree of waste decomposition/
degradation, moisture content of the waste, and waste type/composition.

The waste characterization of the drill core samples refer to the material type: "plastic", "paper", "textiles", "wood", etc., which is common practice in the industry. Since the drill cuttings were not subjected to laboratory analysis, scientific measurements for traits such as BTU value (heat content), biological methane potential (BMP), moisture content (as a percentage), and chemical content (cellulose, lignin, etc.) were not performed.

Ash Hydration: Of the 49 borings, only one (CV-2334) identifies the presence of ash among other waste types, such as plastic, wood, textile, and paper, which suggests that it is present in small quantities that are incidental to the co-mingled nature of typical residential and commercial wastes. Although evidence of the presence of ash can diminish over time because the ash becomes somewhat indiscernible, the fact that large deposits of industrial ash residue were not encountered in any of the borings suggests it is unlikely that ash was a significant portion of the landfilled wastes. Accordingly, it is reasonable to consider ash hydration as an unlikely cause of the ETLF conditions at CCL.

Metals Corrosion: Nineteen (19) of the 49 borings identify the presence of metal among other waste types, such as plastic, wood, textile, and paper. In each case it is listed along with these other waste types, which suggests that it is present in small quantities which are incidental to the co-mingled nature of typical residential and commercial wastes. The fact that large deposits of industrial secondary metals waste (e.g., aluminum dross, casting sands, etc.) were not encountered in any of the borings suggests it is unlikely that reactive metallic waste was a significant portion of the landfilled wastes. Accordingly, it is reasonable to consider metals corrosion as an unlikely cause of the ETLF conditions at CCL.

CONCLUSION ON CAUSATION

Based on SCS' communications with Chiquita, there is no recordkeeping documentation that affirms acceptance of the types of wastes known to have caused other ETLF facilities. Furthermore, based on our visual observation of the drill cuttings at the 49 borings, we see no basis to suspect the cause of the ETLF conditions within the northwestern area at the CCL to be directly attributed to disposal of industrial wastes or special wastes containing dross, other forms of metals, incinerator ash, other types of ash, or sludge/biosolids. Based on SCS' communications with Chiquita, as well as our collective historical knowledge of site operations, we are not aware of slope failures in the northwestern portion of the Facility or substantial waste relocation endeavors that may have contributed to the large-scale heating-event at this Landfill.

SCS finds that the causes of the ETLF conditions at CCL cannot be definitively identified. It is likely that the heat generated within the waste mass from typical anaerobic digestion processes accumulated to a point, inhibiting the second stage of fermentation, acetogenesis, and methanogenesis processes and were replaced by abiotic chemical reactions affiliated with ETLFs that became self-sustaining.

4 SOLUTIONS TO ADDRESS ELEVATION TEMPERATURE LANDFILL REACTION

ETLF CONDITIONS AT CHIQUITA CANYON LANDFILL

To evaluate whether the northwestern area of CCL is exhibiting common symptoms of an ETLF, Chiquita provided the following information for review:

- LFG wellfield monitoring data that includes gas pressure, temperature, and composition (chemical constituents), using both field instrumentation as well as samples submitted for laboratory analysis;
- Landfill liquid (leachate, gas condensate, and LFG wellfield dewatering liquids) quantities, pressure, temperature, and composition data;
- Landfill surface settlement rates based on periodic topographic surveys;
- The frequency and character of on-site odor observations and off-site odor complaints; and,
- First-hand observations of numerous on-site CCL personnel and SCS engineering, construction, and operations and maintenance (O&M) field personnel (on-site daily or with routine periodic frequency), as well as site photographic/video documentation.

Based on interviews of on-site personnel describing their first-hand observations, in conjunction with the information recorded by various parties and reviewed in preparation of this Report, a discrete portion of the waste mass is exhibiting classic symptoms of an ETLF, as opposed to a traditional subsurface oxidation (SSO) or subsurface landfill fire event. The basis for this distinction is as follows:

- Persistent and widespread elevated subsurface and LFG wellhead temperatures in excess of approximately 150°F. While, this condition is present in both ETLF and SSO circumstances, SCS believes the heat observed at this Facility is attributed to ETLF processes and reactions and not attributed to an SSO, because of the absence of charred waste, burning odors, and smoke (differentiated from water vapor).
- Poor gas quality (defined as substantially low methane, e.g., less than 30 percent) in conjunction with methane-to-carbon dioxide (CH_4:CO_2) ratios less than 1.0 and elevated carbon monoxide (CO) concentrations. While this condition is present in both ETLF and SSO circumstances, SCS believes the diminished methane content, inverted ratio, and elevated CO in the LFG at this Facility is attributed to ETLF processes and reactions and not attributed to an SSO. The fact that the LFG has measurable oxygen concentrations, which is unexpected for SSO events because the oxygen is typically fully consumed by the waste combustion, supports this conclusion.
- While there is dramatic and pronounced settlement in the northwest area, SCS does not characterize it as rapid localized subsidence that is typically affiliated with SSO events. SCS believes the overall accelerated settlement of the landfill surface in this area of the Facility indicates ETLF conditions, as opposed to the rapid localized subsidence that typically suggests an SSO event.

- The on-site personnel have noted an unusual increase in leachate quantities as well as numerous instances of pressurized liquids emitting from the landfill surface, from boreholes during drilling, and from LFG wells in the northwest portion of the waste footprint. The production of excess liquid quantities and the presence of pressurized liquids are common for landfills with ETLF conditions, but are atypical of SSO events.

- The concentration of hydrogen (H_2) in the LFG at 25 wells and collectors has been measured in the range of 1 to 20 percent by volume. Hydrogen content in LFG at concentrations generally greater than 5,000 ppm is affiliated with ETLF, not SSO events.

- The presence of DMS in the LFG at concentrations in the range of 100 ppm have been recorded at the Facility. Elevated DMS concentrations, with respect to other reduced sulfur compounds, is typical for sites experiencing ETLF conditions.

- The characteristic of the odors originating from the northwest section of the Facility has been described as "chemical-like" (consistent with correspondence from Los Angeles County, dated 9/1/23) and has been observed by Chiquita and SCS personnel to be notably and distinctly different from typical LFG or landfill working face odors. This is a common observation at ETLF sites.

Based on recent and historical methane concentrations recorded at numerous wellheads within the Reaction Area at CCL that exhibited temperature in excess of 145°F, methanogenic bacteria are continuing to accomplish anaerobic decomposition of organic waste materials in conjunction with a periodic increase of other decomposition byproducts, such as hydrogen.

The conditions at CCL include elevated temperatures measured in the LFG and liquids, high pressures, an inversion of methane to carbon dioxide ratios, an increase in generation of gas and liquids, increased concentrations of hydrogen and DMS, accelerated settlement, and unusual and increased odors. These objective data and conditions occur at ETLFs, and not at landfills undergoing typical decomposition conditions.

The conditions at CCL resemble an ETLF event and do not suggest other types of landfill heating events, such as a subsurface fire. Landfills with subsurface fire events do not produce hydrogen. ETLFs do produce hydrogen. Landfills with subsurface fire events do not produce liquids. ETLFs do produce liquids. The data shows that CCL is producing hydrogen and liquids as well as exhibiting a methane to carbon dioxide ratio indicative of an ETLF. The settlement at the Landfill surface in the Reaction Area is broad and pronounced, rather than in discrete and isolated portions. In addition, personnel involved in daily operation at the Landfill experienced for over multiple months odors of a different character than odors produced from a landfill fire event. In fact, the correspondence from the County cites "chemical-like odors", which characterizes the odors as distinctly different than the odor character usually noted at landfills experiencing subsurface fires.

SOLUTIONS TO SLOW AND STOP REACTION

Previous experience at other ETLF landfills demonstrates that landfill reactions and resulting odors have been mitigated by best management practices, including increased gas extraction and liquid removal (e.g., through expanding systems and providing adequate LFG control capacity and leachate disposal capacity). Another best management practice is to improve cover integrity, which reduces infiltration of precipitation and limits the amount of excess liquids available to sustain various chemical reactions. Implementing these measures will help slow the reaction and mitigate impacts. However, no known method has been identified to quickly stop the reaction leading to elevated

temperatures in a landfill. The landfill industry has embraced several approaches to "contain and manage" the reaction area as outlined below:

- Enhanced gas collection and control infrastructure to remove reaction gases, reduce landfill pressures, reduce malodorous emissions, and remove heat.

- Enhanced liquids removal to improve gas collection efficiency and remove heat through the installation of in-well dewatering pumps. Removing landfill liquids removes heat, as well as allows gas to be collected from greater depths in the landfill, the increase in temperature is often a necessary side-effect of pumping operations that remove heat from these portions of the waste mass.

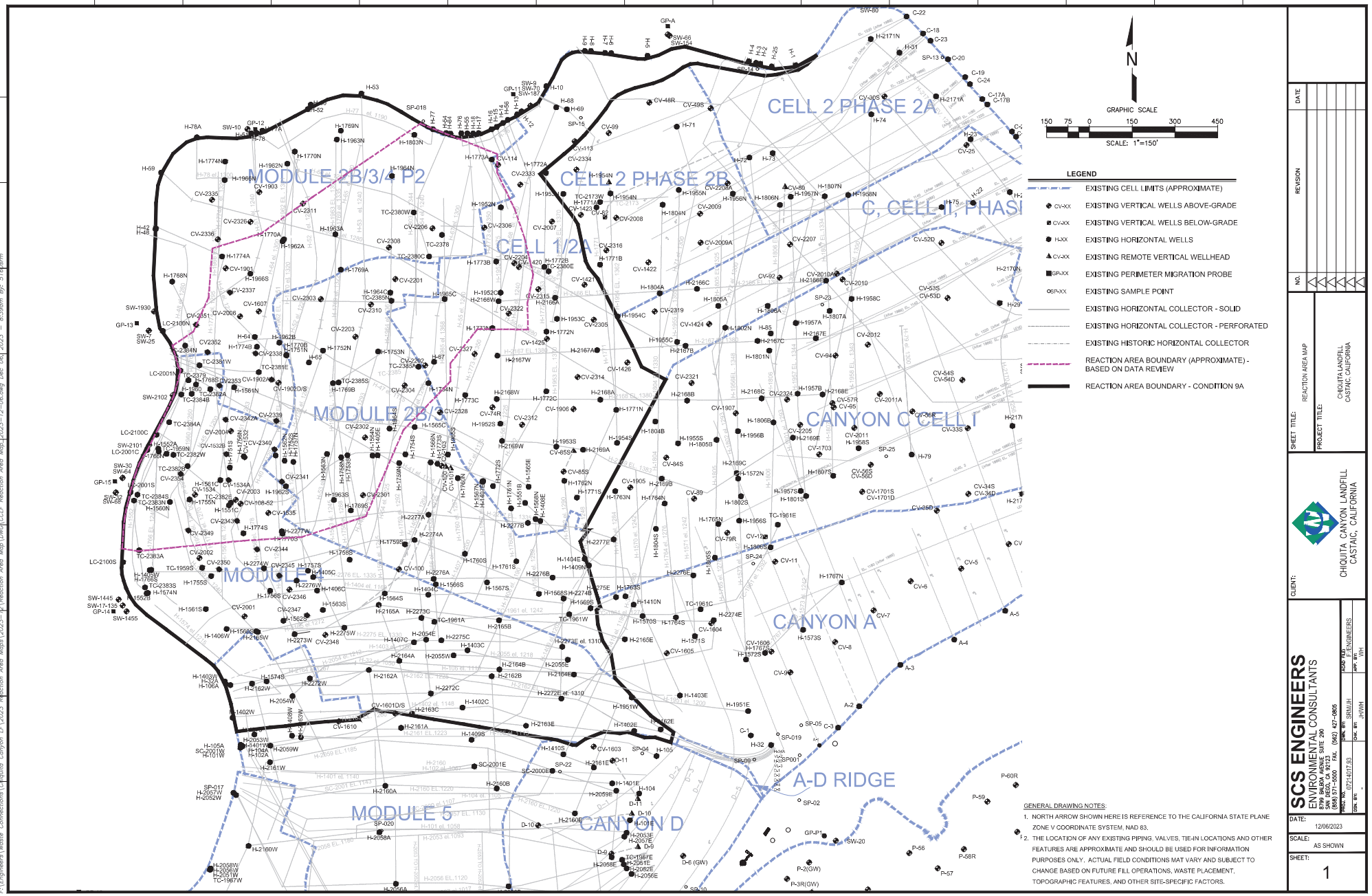
- Enhanced interim or final cover installation to further enhance gas recovery and reduce surface emissions and resulting odors.

As a practical matter, obtaining higher operating values (HOVs) for wells exhibiting elevated temperatures due to abiotic chemical reactions versus subsurface oxidation will assist the Facility in its goal of removing heat via gas and liquid extraction and reduce unnecessary frequent monitoring of carbon dioxide.

As demonstrated at the other landfills that have experienced widespread ETLF heating events during the past approximate 15 years, Chiquita and SCS are confident that implementation of the best management practices developed by the landfill industry to contain and manage the reaction will succeed in slowing the propagation of the reaction area, result in cooling of the buried wastes, enable methanogenesis to ultimately be re-initiated within a large section of the affected waste mass, and mitigate and abate the detrimental impacts, such as odors, being experienced by surrounding off-site communities.

Appendix A

Reaction Area Map



GENERAL DRAWING NOTES:

1. NORTH ARROW SHOWN HERE IS REFERENCE TO THE CALIFORNIA STATE PLANE ZONE V COORDINATE SYSTEM, NAD 83.
2. THE LOCATION OF ANY EXISTING PIPING, VALVES, TIE-IN LOCATIONS AND OTHER FEATURES ARE APPROXIMATE AND SHOULD BE USED FOR INFORMATION PURPOSES ONLY. ACTUAL FIELD CONDITIONS MAT VARY AND SUBJECT TO CHANGE BASED ON FUTURE FILL OPERATIONS, WASTE PLACEMENT, TOPOGRAPHIC FEATURES, AND OTHER SITE-SPECIFIC FACTORS.

NO.	REVISION	DATE

SHEET TITLE: REACTION AREA MAP

PROJECT TITLE: CHICUITA LANDFILL CASTAIC, CALIFORNIA

CLIENT: CHIQUITA CANYON LANDFILL CASTAIC, CALIFORNIA

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PROJECT NO. 07214017.83 | PROJ. MGR. SRM/JH | P.E./ENGINEERS
DSN. BY: | DWN. BY: | CHK. BY: JH/WH | APP. BY: WH

DATE: 12/06/2023

SCALE: AS SHOWN

SHEET: 1

F:\Engineers\Waste Connections\Chiquita Canyon LF\2023 Reaction Area Maps\2023-12\Reaction Area Map\DWG\CCLF Reaction Area Map 2023-12-06.dwg Dec 06, 2023 - 8:39am By: 516orm

Appendix B

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BEFORE THE HEARING BOARD OF THE

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

In The Matter Of SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, Petitioner, vs. CHIQUITA CANYON, LLC a Delaware Corporation, [Facility ID No. 119219] Respondent.	**Case No. 6177-4** **EXHIBIT G TO SUPPLEMENTAL DECLARATION OF ROBERT E. DICK, P.E., B.C.E.E.** Health and Safety Code § 41700, and District Rules 402, 431.1, 3002, 203, 1150 Hearing Date: January 16, 2024 Time: 9:30 am Place: Hearing Board South Coast Air Quality Management District 21865 Copley Drive Diamond Bar, CA 91765

November 3, 2023
File No. 01204123.21-13

Mr. Baitong Chen
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Subject: DMS Committee Determination on Dewatering Wells Exhibiting Worst Liquid Impact
Chiquita Canyon Landfill – Castaic, California

Dear Mr. Chen:

In accordance with Condition No. 17 of the Stipulated Order of Abatement (SOFA) pertaining to the Chiquita Canyon Landfill (Facility) (Case No. 6177-4), the DMS Committee has reviewed landfill gas (LFG) wellfield liquid level measurements and dewatering pump data recorded on 11/1/23 at the subject Facility, and has prepared this determination to confirm that the Facility has successfully accomplished the installation of dewatering pumps at greater than 20 percent of the LFG collection wells with the worst liquid impaction issues in the Reaction Area.

For purposes of this determination, the DMS Committee understands the Reaction Area boundary to be as prescribed in the DMS Committee's October 6 boundary determination (which corresponds to the limits of Cells 1/2A, 2B/3, 4, and Module 2B/3/4 P2). The DMS Committee also understands that "landfill gas collection wells," as used in Condition No. 17, means vertical LFG extraction wells and does not include horizontal collectors, since it is generally infeasible to install pneumatic dewatering pump equipment into a horizontal collector.

The DMS Committee identified the existing LFG vertical extraction wells that exhibited the "worst liquid impaction issues" based on the following criteria:

- Lowest "Depth-to-Liquid" Distance: The LFG system operator routinely measures the distance from the well riser pipe "top-of-casing" to the point where the surface of accumulated liquid is present within the well piping. The lowest measured distance often correlates to the highest liquid elevation within the waste matrix, constituting one aspect of the "worst liquid impaction issue".

- Greatest "Liquid Column Depth" Measurement: The LFG system operator routinely measures the distance from the well riser pipe "top-of-casing" to the bottom of the well (or has previously established the total well depth). The Liquid Column Depth is established by subtracting the Depth-to-Liquid measurement from the total well depth measurement. The greatest calculated Liquid Column Depth constitutes one aspect of the "worst liquid impaction issue".

- Lowest Length of "Open Perforated Pipe Available": The total length of perforated well riser piping is recorded during well construction and is documented on the well boring logs. A comparison of the Depth-to-Liquid distance measurement with the known depth to where solid-wall piping transitions to perforated piping within the well enables calculation of the

portion of the perforated pipe that is "open" or "available" (i.e., the length of pipe that exists above the surface of accumulated liquid). The lowest calculated Open Perforated Pipe Available constitutes one aspect of the "worst liquid impaction issue".

Based on a review of these criteria, the DMS Committee has determined that 25 wells within the Reaction Area boundary are the wells with the worst liquid impaction issues. As of November 1, 2023, pumps were installed in 22 of the wells determined to have the worst liquid impaction issues in the Reaction Area. Thus, the Facility has installed pumps within 88 percent of the wells with the "worst liquid impaction issues" (22 out of 25). Accordingly, these proportions exceed the 20 percent stipulated by Condition No. 17.

Also, at this time, the Facility has not determined that installation of a pump in any well is infeasible, thus there is no statement in the monthly report on this circumstance warranted per Condition 17.a.

Please contact either of the undersigned if you have questions or require additional information.

Sincerely,

Robert E. Dick, PE, BCEE
Senior Vice President
SCS Engineers

Patrick S. Sullivan, BCES, CCP
Senior Vice President
SCS Engineers

RED/PSS

cc: Nathaniel Dickel, SCAQMD
Christina Ojeda, SCAQMD
Pablo Sanchez Soria, PhD, CIH, CTEH
Neal Bolton, PE, Blue Ridge Services, Inc.
Angie Perez, PhD, CIH, CTEH
Srividhya Viswanathan, PE, SCS Engineers